

DOCUMENT RESUME

ED 083 331

UD 013 851

AUTHOR Kallen, David J., E.
 TITLE Nutrition, Development, and Social Behavior.
 Proceedings of the Conference on the Assessment of
 Tests of Behavior From Studies of Nutrition in the
 Western Hemisphere.
 INSTITUTION National Inst. of Child Health and Human Development
 (NIH), Bethesda, Md.
 SPONS AGENCY Pan American Health Organization, Washington, D.
 C.
 REPORT NO DHEW-NIH-73-242
 PUB DATE 73
 NOTE 378p.
 AVAILABLE FROM Superintendent of Documents, U.S. Government Printing
 Office, Washington, D.C. 20402 (Stock #1746-00014,
 Paper - \$2.60 domestic postpaid; \$2.25, G.P.O.
 bookstore)
 EDRS PRICE MF-\$0.65 HC-\$13.16
 DESCRIPTORS Animal Behavior; *Cognitive Development; Community
 Involvement; Disadvantaged Environment; Early
 Childhood; Environmental Influences; Field Studies;
 *Individual Development; Infants; *Intelligence;
 Intervention; *Nutrition; *Social Behavior; Social
 Class; Visual Perception

ABSTRACT

Contents of this book include the following papers,
 followed by discussion and comment: "Malnutrition and Animal
 Behavior," David A. Levitsky and Richard H. Barnes; "Malnutrition in
 Infants," Henry N. Ricciuti; "Nutrition and the Community," David J.
 Kallen; "A Methodological Note: The Development of Visual Attention
 in Infants," A. C. Mundy-Castle; "Some Methodological Problems in
 Field Studies of Nutrition and Intelligence," Robert E. Klein,
 Jean-Pierre Habicht and Charles Yarbrough; "Nutrition and Behavior in
 Head Start Children: Results from the Tulane Study," Jefferson L.
 Sulzer, Wesley J. Hansche and Frederick Koenig; "Nutrition and
 Behavior: Practical Problems in Field Studies in an Urban Community,"
 Fernando E. Monckeberg; "Behavioral Intervention Studies with
 Malnourished Children. . .," Harrison E. McKay, Arlene McKay and
 Leonardo Sinisterra; "Cognitive Development," Jerome Kagan;
 "Assessment of Cognitive Development in Deprivation and
 Malnutrition," Francisco Cobos and Luis Guevara; "Social Stratum and
 Restricted Life Chances," F. B. Waisanen and Eugenio Fonseca T.;
 "Modernization as a Strategy in Nutrition and Mental Development
 Research," Alfredo Mendez D.; "Competence and Options: A Theoretical
 Essay, Implications for Nutritional Research," Marvin B. Sussman;
 "Measuring Role Competence," Sigmund E. Dragastin; "Behavioral and
 Social Aspects," A. Kimball Romney; "Medical and Environmental
 Aspects," Joseph J. Vitale; and, "Concluding Remarks," Joginder G.
 Chopra. (JM)

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NUTRITION,
DEVELOPMENT AND
SOCIAL BEHAVIOR

Proceedings of the Conference on the Assessment of
Tests of Behavior from Studies of Nutrition in the
Western Hemisphere

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Conference Co-Sponsors:

National Institute of Child Health and Human Development
Pan American Health Organization

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
National Institutes of Health
DHEW Publication No. (NIH) 73-242

UD 013851

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Library of Congress Catalog
Card Number 72-600203

For sale by the Superintendent of Documents, U.S. Government Printing Office,
Washington, D.C. 20402 — Price: Paper cover — \$2.60 domestic postpaid,
or \$2.25 GPO Bookstore
Stock Number 1746-00014

ACKNOWLEDGMENTS

The preparation of a volume of this nature depends on the effort and cooperation of a number of people. First and foremost, the Conference participants gave generously of their time and effort, both in attending the Conference and in revision of papers. Editorial suggestions were responded to cheerfully and promptly.

As editor, I am pleased to acknowledge the support of Dr. Merrill S. Read, NICHD, Joginder G. Chopra, PAHO, and Dr. Robert Klein, INCAP, Conference Co-Chairman.

There are additional people without whose aid this report would never have been completed. Professor Lyle Blair of the Michigan State University Press provided valuable help in the editorial process, making sure that meaning and sense were communicated. Miss Bonnie Mollenkopf of the Department of Human Development, Michigan State University, handled correspondence with the contributors, organized the manuscript and my work schedule with competence and cheerfulness.

David J. Kallen
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PREFACE

Malnutrition is one of the major problems afflicting the children of the world. It has been estimated recently that three hundred million children suffer from malnutrition. A sizeable number of these live in the Western Hemisphere. Although malnutrition has long been recognized as a problem for the developing countries in Central and South America, recent reports indicate that varying types of undernutrition also may be found in the United States.

It is clear that malnutrition has a direct influence on physical growth and maturation. The ability to resist infectious agents also is markedly influenced by nutrition, particularly among young children. More recently, data have accumulated suggesting a role of malnutrition in mental development. This possibility has an even greater significance for the emerging nations, influencing as it would the ability for individuals to participate in a complex society.

Over the last decade it has grown increasingly evident that an understanding of the relation between malnutrition and intellectual development requires the clarification of at least three issues. First, we must adapt or develop behavior tests which are significant indicators of cognitive development and which are applicable across a broad range of cultures. Second, since it is doubtful that a physiologic stress affects all aspects of cognitive growth equally, it is necessary to identify measures which are especially useful in estimating particular aspects of developmental competence and the relation of these to nutritional stresses. Third, it must be recognized that malnutrition is almost always associated with cultural disadvantage and with the general stress of environmental and familial inadequacies, which may in themselves affect cognitive growth. Therefore, an appropriate technique is required for separating nutritional from socio-cultural influences as well as for evaluating the interaction between the two sets of variables.

The present volume summarizes the proceedings of a Western Hemisphere Conference on "The Assessment of Tests of Behavior from Studies of Nutrition in the Western Hemisphere," held in Mayaguez, Puerto Rico, from October 20 to 23, 1970, under the joint sponsorship of The National Institute of Child Health and Human Development and the Pan American Health Organization.

The Conference was directed to methodologic problems in field studies on nutrition and mental development, the social setting of malnutrition which in turn has an impact on intellectual growth, and the possible relation between malnutrition and social growth or functional competence. The discussions of the conference indicated a need for further multidisciplinary investigations in a variety of settings taking into consideration malnutrition, socio-cultural, and psychological influences on the development of children.

The thirty-three Conference participants represented the disciplines of pediatrics, nutrition, psychology, sociology, anthropology, and public health. The Conference included a relatively equal number of scientists from the USA and Latin America. The speakers and discussants were from most of the institutions throughout this hemisphere currently engaged in research on this and related subjects.

The National Institute of Child Health and Human Development and the Pan American Health Organization are grateful to those who participated in the lively and creative discussions during the meeting. It is hoped that others will find the contents of this volume useful in improving the design of studies of malnutrition and mental development. Furthermore, the information presented here will be useful in broadening the understanding of the many factors which must also be taken into account in developing services for the world's children.

Dr. Abraham Horwitz
Director
Pan American Sanitary
Bureau

Dr. Gerald D. LaVeck
Director
National Institute of Child
Health and Human Development

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I



Theoretical and Methodological Issues in the Study of Nutrition and Mental Development

Malnutrition and animal behavior

David A. Levitsky and Richard H. Barnes

Malnutrition in infants

Henry N. Ricciuti

Nutrition and the community

David J. Kallen

A methodological note: The development of visual attention
in infants

A. C. Mundy-Castle

Summary of resulting discussion

MALNUTRITION AND ANIMAL BEHAVIOR

by

David A. Levitsky and Richard H. Barnes*

The use of animal models to study the behavioral effects of malnutrition has many obvious advantages. First and most important, animal studies can be considerably more controlled. The diet composition is accurately determined. The onset and duration of the period of malnutrition is controlled as well as the environment and social conditions. Secondly, the extreme limits of malnutrition may be examined. Finally, economic feasibility, both in terms of money and time, makes the use of animal behavior studies in nutrition research quite desirable.

There are, however, several methodological problems and theoretical questions which must be answered before the results of animal behavior studies can be seriously accepted as being relevant to human application. It is the intent of this paper to explore such issues and examine the literature in an attempt to answer them. In addition, an hypothesis is proposed which may help explain the behavioral abnormalities which result from early malnutrition.

Early Malnutrition and Animal Learning

Certainly, of all the possible behaviors which may be affected by early malnutrition, learning (intelligence) has received the greatest attention. However, one of the most difficult problems in attempting to study learning, as pointed out by Tolman many years ago (Tolman and Honzig, 1930), is that we can never observe the learning process directly, only its effect on performance. Unfortunately for the observer, the performance of an animal in any given learning situation is determined by many factors, not merely learning alone. Some of these factors include the level of motivation, the incentive value of the reinforcement, and the emotionality of the animal. In order to draw any conclusions about the learning process of malnourished or previously mal-

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nourished animals it is necessary to demonstrate either no difference in these factors between experimentals and controls, or to use a test which has been found to be relatively insensitive to differences in these factors.

This problem becomes exceedingly complex when food is used as a reinforcement. It is known that early experience with food restriction results in differences in adult feeding behavior. These effects have been observed as increased hoarding of food (Wolfe, 1939; Hunt, 1941; Hunt, *et al*, 1947), increased rate of consumption (Marx, 1952; McKelvey and Marx, 1951; Mandler, 1958), and increased rate of instrumental responding for food in the rat (Mandler, 1958). Increased rate of eating has also been observed in the dog as a result of early food restriction (Elliott and King, 1960). Barnes, *et al*, (1968) reported a difference in feeding behavior of adult rats which had been protein-calorie malnourished early in life. This difference manifested itself as an increase in the spillage of food during a one-hour feeding test. The observation was later confirmed by Levitsky and Barnes (1969). Moreover, there appears to be a long term effect of early malnutrition on food intake. Increased food consumption, when expressed by unit surface area, has been found in adult rats whose mothers were maintained on 50% of normal intake during gestation and lactation (Lee and Chow, 1965; Blackwell, *et al*, 1969), and in rats malnourished during lactation and the first four weeks postweaning (Barnes, *et al*, 1968; Levitsky and Barnes, 1969a). Thus if food is used as reinforcement for animals which have been previously malnourished, one may question whether the reinforcement has the same "incentive value" as in the control group.

This last point becomes particularly evident when food is used as a reinforcement in animals which are concurrently being maintained on a deficient diet. Griffiths and Senter (1954) maintained weanling rats on an extremely low protein diet until sixty days of age at which time they were tested in a multiple-Y maze. During testing the low protein animals and the controls were deprived of food for 22 hours and were rewarded with either a balanced diet or the protein deficient diet for traversing the maze. They found that the protein deficient rats made fewer errors when running the maze to a goal consisting of a balanced diet than when the reinforcement was the low protein diet. Moreover, the protein deficient animals receiving the balanced diet as the reinforcement performed better than controls running to the same food. This study demonstrates quite clearly that the incentive value of the reinforcement is different for animals maintained on different diets and this way may affect error scores in the maze learning situation. Several published studies

purporting to show poorer learning of rats maintained with diets containing low protein or poor protein are susceptible to this criticism (Bevan and Freeman, 1952; Riess and Block, 1942; Cowley and Griesel, 1959, 1963, 1966; Rajalakshmi, *et al*, 1965).

One possible solution to this incentive problem is simply to avoid food as a reinforcement. Several studies have utilized a water maze where the reinforcement was escape from cold water (Bernhardt, 1936; Cowley and Griesel, 1962; Barnes *et al*, 1966). Others have used avoidance of an electric shock as the source of motivation (Frankova and Barnes, 1968a; Guthrie, 1968; Barnes, *et al*, 1970). Such avoidance or escape learning tasks, however, involve considerable stress. Levitsky and Barnes (1970) have reported that one behavioral effect of early malnutrition is to increase the sensitivity of rats to aversive stimulation. Thus, even in the avoidance or escape learning situation, the performance of the animal may be confounded by motivational and emotional variables.

There is another facet to the problem of the interpretation of results from earlier studies of malnutrition and learning which deserves serious attention. In many of these studies it is not entirely clear as to what extent the experimental groups "learned" the problem. Consider, for example, figure 1a. If these data represented the number of errors per trial in a maze, it would be fairly clear that the experimentals learned the maze, that is, eliminated errors, at a slower rate than the controls. What is important is the fact that the experimentals finally arrived at the same asymptote as the controls. However, observe figure 1b. Here the experimental animals reach an asymptote of final performance at a different level than the controls. Learning is conventionally defined as "a more or less permanent change in behavior which occurs as the result of practice" (Kimble, 1961, p. 2). Thus learning is observed as a change in performance, not as the final level of performance. The data in figure 1b probably do not reflect differences in learning, even though more errors are committed by the experimentals. More likely the results reflect differences in performance variables.

In many of the studies reported in the literature which purport to show the deleterious effect of early malnutrition, no data are presented as to the final asymptotic performance level or even if a criterion condition was met (Cowley and Griesel, 1959, 1962, 1963; Ottinger and Tanabe, 1970). In several papers, the level of performance of experimental and control animals are shown graphically to be quite parallel (Caldwell and Churchill, 1966, 1967; Simonson and Chow, 1970). In these later studies it is certainly not clear if scores reflect learning ability or motivational variables.

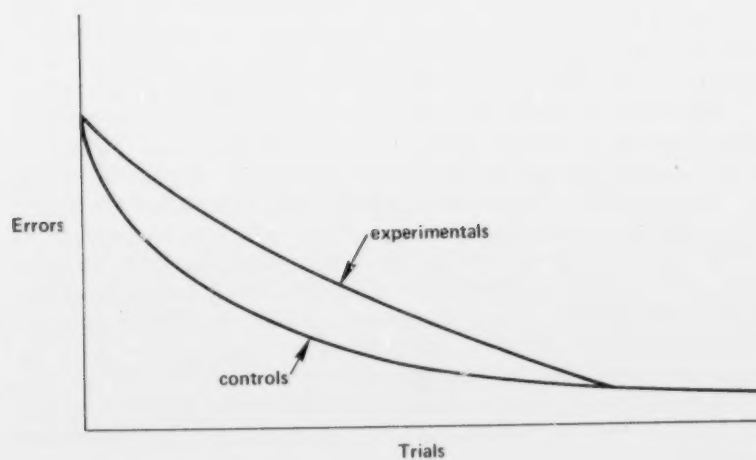


Figure 1a.

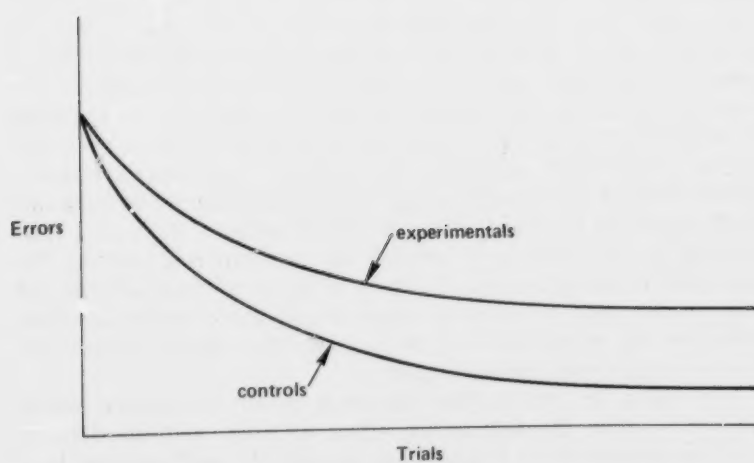


Figure 1b.

FIGURE 1. Reduction of errors in learning trials.

An additional comment should be made concerning the studies of Cowley and Griesel (1959, 1962, 1963, 1966). In all of these reports the major test used to assess learning (intelligence) was the Hebb-Williams maze. This test, which utilizes food as a reinforcement (except in the 1962 reference in which the test was modified into a water maze) has been reported to be insensitive to differences in level of food motivation and the emotionality of the subjects (Das and Broadhurst, 1959). Cowley and Griesel report that the method of testing was adopted from a procedure described by Rabinovitch and Rosvold (1951). This procedure has become more or less standardized in animal experiments using the Hebb-Williams maze and involves an extensive adaptation period in which the rat is shown where the food is located across an enclosed chamber. Following adaptation various barriers are placed in the chamber. The rat eventually learns the shortest route to the food. There are various configurations or problems which can be erected within the chamber, and the method described by Rabinovitch and Rosvold (1951) suggest eight trials per problem. Cowley and Griesel, however, in all their reports utilized only one test per problem following the adaptation. Thus, it is quite doubtful if learning was measured, especially in light of the fact that the original method describing the operation of the test recommended that the first run following adaptation always be disregarded (Hebb and Williams, 1946).

In view of the above criticism and the many studies reported in the literature where no detrimental effect on learning was observed (Anderson and Smith, 1926, 1932; Ruch, 1932; Biel, 1938; Pilgrim, *et al.*, 1959; Guthrie, 1968; Howard and Granoff, 1968; Frankova and Barnes, 1968; Collier and Squibb, 1968), the conclusion that malnutrition results in an impairment in the learning ability of animals appears to be ill founded. This is not to say, however, that early malnutrition does not produce behavioral effects which may or may not interfere with behavior or performance in a learning situation. The point to emphasize is that the effect on the learning process, *per se*, has not been sufficiently proven.

Other Effects of Malnutrition on Animal Behavior

Several investigators have commented on differences in apparent emotionality between controls and animals which had been previously malnourished or were currently being malnourished (Bevan and Freeman, 1952; Barnes, *et al.*, 1966, 1970; Howard and Granoff, 1968). Cowley and Griesel (1962) noted that malnourished experimental rats scored fewer errors in a Hebb-

Williams water maze under non-stress conditions (water temperature averaged 16.4° C.), but exhibited significantly more errors when tested under "stress" (water temperature was 10.2° C.). In a subsequent study, Cowley and Griesel (1964) observed increased emotionality of malnourished rats on a number of behavioral tasks: increased latency of emergence from home cage, decreased locomotion in an open field, increased defecation, and increased suppression of movement by noise.

Lat, Widdowson and McCance (1960) nursed rat pups in large litters to induce nutrition inadequacy. They observed that such treatment increases the "Non-specific Excitability Level" of the adult. Guthrie (1968) found decreased rearing responses in an open field in previously malnourished but rehabilitated rats, but no differences in locomotion or defecation scores. Frankova and Barnes (1968b) observed consistent reduction in rearing and locomotion in an open field in rats previously malnourished. In another paper (Frankova and Barnes, 1968a) several behavioral abnormalities of the previously malnourished rats were observed in a shock avoidance situation. Barnes (1970) reported many signs of excessive emotionality in pigs subjected to mildly stressful situations. Simonson and Chow (1970) also reported increased emotional behavior of rats whose mothers were given a reduced food intake during gestation and lactation.

Levitsky and Barnes (1970) attempted to analyze this difference in emotional behavior in greater detail. They observed that rats which were previously malnourished early in life showed a greater behavioral response to a loud noise, demonstrated greater passive avoidance of an electric shock, and would bar press at a greater rate in order to postpone an electric shock. They concluded that animals which experience protein-calorie malnutrition early in life are more sensitive to aversive stimulation and therefore exhibit greater emotionality.

Finally, Zimmerman has observed (personal communication) that monkeys maintained on low protein diets display considerably more emotional behavior than well-nourished controls. These responses are evident in many social situations and are particularly noticeable when the subject is presented with a novel object. Young monkeys are typically very curious and will explore new objects placed within their reach. Malnourished monkeys, however, show fear and withdrawal responses to these objects. This observation becomes extremely meaningful when tests of learning set are attempted. If the experimental subjects are well adapted to the situation and the test objects, no discernable difference in learning ability is detected. If some of the objects are novel or the subjects are not adequately adapted to the situation, then the controls appear to be far superior in the learning situation.

Although early malnutrition has not been adequately shown to produce deleterious effects on the learning process directly, it may influence performance in a learning situation by affecting the emotionality of the animal. It should then be possible to arrange a learning-performance situation in such a way as to show either an enhanced or a depressed learning-performance as a function of malnutrition according to a testing situation. Yerkes and Dodson (1908) pointed out many years ago that an optimum level of motivation exists for problem solving which varies inversely with task difficulty. Others have reworded the *Yerkes-Dodson Law* in terms of arousal or emotionality (Bindra, 1959; Malmö, 1959; Hebb, 1949; Leuba, 1955; Lat, 1963). For simple learning tasks, then, it should be expected that the learning-performance of previously malnourished animals should be superior to controls, where on more complex tasks or more stressful conditions the opposite should be true, as was observed by Cowley and Griesel (1962).

Similarity Between Malnutrition and Environmental Isolation

There are several striking similarities between the effects produced by early protein-calorie malnutrition and those observed following early environmental isolation. First, environmental isolation leads to increase in emotionality in dogs (Melzak, 1954; Thompson, *et al*, 1956), cats (Riesen, 1961), rats (Ader and Plaut, 1968; Stern, *et al*, 1960), mice (Weltman, *et al*, 1966), and monkeys (Mason, *et al*, 1968). Moreover, additional stimulation experienced early in life reduces emotionality (Denenberg and Morton, 1964; Levine, 1959). Second, early environmental stimulation appears to have physiologic effects such as increased body growth (Denenberg and Karas, 1959; Levine and Otis, 1958; Altman, 1968), increased brain weight (Tapp and Markowitz, 1963), increased rate of brain myelinization (Levine and Lewis, 1959), increased cortical dendritic arboration (Schapiro, *et al*, 1970) and increased brain acetylcholinesterase (Rosensweig, *et al*, 1962; LaTorre, 1969). Early malnutrition, on the other hand, results in a reduced body weight (e.g., Barnes *et al*, 1966), smaller brain weight (Culley and Lineberger, 1968), decreased rate of myelinization (Dobbing and Widdowson, 1965; Guthrie and Brown, 1968) and inhibited dendritic arboration (Horn, 1955; Eayrs and Horn, 1955), and decreased brain acetylcholinesterase (Sereni, *et al*, 1966). Finally, the effects of early stimulation and early malnutrition need only be administered during early development in order to have long term behavioral effects

which are still evident at maturity. It therefore does not seem unreasonable to suggest that both malnutrition and environmental stimulation experienced early in life may affect behavior through the same mechanism.

Programming Hypothesis of Long-term Behavioral Abnormalities

The similarities between the effects of early malnutrition and environmental isolation has stimulated the formulation of a theoretical model to account for the long-term effects of early malnutrition. It is heavily based upon the developmental model of Hebb (1949) and Melzak's (1965) model of excess emotional abnormality. Essentially the model assumes, rather safely, that the behavioral response of an adult in a given situation is a function of experience with the environmental stimuli and the reinforcement history of the particular response. The model further assumes that the organism, or at least the rat, is most sensitive to experience with environmental stimulation during the first three or four weeks of its life. The more experience the animal has with different kinds of stimulation early in life, the better able it will be to cope with environmental stimuli later in life. But malnutrition produces a condition which makes the animal less susceptible to environmental programming. This condition may be of a physiological or biochemical nature which may prevent the storage of environmental information or may be strictly behavioral in nature, that is, the animal, being malnourished, engages in behavior not compatible with maximizing the input from the environment. Such differences in behavior during the period of malnutrition have been clearly observed in monkeys in preliminary work by Zimmerman (personal communication). He reports that young monkeys maintained on a low protein diet do not play with their peers as much as controls and spend much more time in self stimulation than normal controls. He also points out that this kind of behavior is quite characteristic of monkeys reared without their mothers. Moreover, as mentioned earlier, these monkeys avoid novel objects and thus do little exploration of their environment. Thus, the resultant behavior of an adult animal which had been malnourished early in life may be quite similar to one deprived of environmental stimulation.

The test of such a model rests upon a factorially designed experiment in which diet and environmental stimulation are varied orthogonally. The animal would be less susceptible to the effects of environmental stimulation than a well nourished animal. Frankova (1968) has reported some data to support this predic-

tion. She found the effects of handling (stimulation) to be significantly greater in well-nourished animals than malnourished rats. Moreover, it might be predicted that the detrimental effects of environmental isolation should be exaggerated by malnutrition.

Another very important deduction can be made from this model. Since it is assumed that the long term, abnormal behavioral effects of early malnutrition and environmental isolation are produced by the same mechanism, it should be possible to reverse the effects of early malnutrition by subsequent environmental stimulation. There exists some suggestive evidence that this kind of treatment may well be effective. Further tests of these predictions and the model itself are currently under way in our laboratory. These results should be extremely useful for further research, theory, and application to humans.

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MALNUTRITION IN INFANTS

by

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This paper focuses on a discussion of two interrelated methodological issues which confront us in research on malnutrition and psychological development in infancy. Primary interest is centered on the problem of specifying and assessing the most functionally relevant behavioral, learning, and other psychological outcomes of malnutrition in the infant. Some consideration is also given to the related problem of isolating the influence of malnutrition *per se* from that of related social, environmental, and biological factors, as well as determining the manner in which these two major sources of influence interact in jointly affecting psychological development.

Specification and Measurement of the Most Functionally Relevant Dimensions of Behavioral and Psychological Development Likely to be Influenced by Malnutrition

NATURE OF THE GENERAL PROBLEM

The problem of improving our conceptualization, measurement, and empirically based knowledge of salient aspects of psychological development in infancy is a matter of widespread contemporary concern among psychologists interested in the early development of humans. This represents a theoretical and methodological problem of particular importance to investigators concerned with the influence of experience on early development, as well as to those concerned with the developmental consequences of malnutrition. Briefly, in both instances the problem boils down to a familiar question. Given our objective of determining the effects of malnutrition (or of variations in experience) upon early psychological development, what behavioral or de-

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developmental outcomes should we assess, and how can we do so reliably and validly?

In approaching this question, the following considerations represent important guidelines or criteria:

Theoretical or conceptual relevance of behaviors or functions to be measured in the context of contemporary developmental knowledge and theory.

In recent years there has been a significant broadening of empirically based knowledge and theoretical formulations concerning behavior and psychological development in infancy (Kessen, 1970; Brackbill, 1967). This work provides a rich source of potentially fruitful leads with respect to psychologically relevant functions and behaviors that could profitably be examined in research on malnutrition.

Relevance of behaviors assessed with respect to adaptive functioning in "real life."

Ultimately, we are concerned with behavioral or developmental outcomes of malnutrition which have some relevance to the infant's or young child's developing competence and adaptation to the real world. There are a good many behaviors or psychological functions which ought to be assessed because of their theoretical relevance, even though their relationship to social competence, achievement, or capacity to learn in the natural environment may not yet have been empirically demonstrated (e.g., certain complex perceptual discriminations). At the same time, there is considerable value in the assessment of behavioral outcomes which reflect gross but obviously important developmental competencies or deficiencies during infancy, even though the theoretical significance of such measures may not be entirely clear (e.g., infant development tests).

Likelihood that behaviors or functions assessed are sensitive to changes produced by nutritional deprivation.

Recent and contemporary research on malnutrition with both animals and humans provides continuing leads which ought to guide investigators in selecting for investigation those aspects of infant behavior and development most likely to be susceptible to nutritional deficiencies.

Degree of stability or lability of behaviors measured as a consequence of variations in social environment and/or experience.

While it is not always possible to specify the environmental "stability" or "lability" of various behaviors, this is an important

consideration particularly if one is attempting to identify behavioral outcomes that are primarily a consequence of *nutritional* rather than social or experiential "shortcomings" of the infant's environment. For example, in the second year of life language and social behavior are very much influenced by variations in experience, hence one has to be particularly careful to take this into account when attempting to evaluate nutritional influences on such behavior. On the other hand, some of the more formal perceptual-cognitive functions and structures of current interest (Gibson, 1969; Kohlberg, 1968) may be considerably less susceptible to recent environmental variations, which would be an advantage if we are concerned primarily with nutritional effects on such functions.

Reliability with which behaviors can be measured

This is a basic and familiar criterion, which becomes a particularly important consideration when we attempt to use procedures in different parts of the world with many different examiners, often with adaptations required to make the procedures appropriate for use in different cultures.

MOST COMMONLY USED PROCEDURES: INFANT TESTS

Perhaps because of the great interest in the influence of malnutrition on intellectual development, including mental retardation, the most commonly used assessment procedures in studies of malnutrition during the first two to three years of life have been the infant tests of general development (e.g., Gesell [Cravioto and Robles, 1965], Bayley [Pollitt and Granoff, 1967], Griffiths [Akim, McFie, and Sebigajju, 1956]). These procedures require the elicitation and observation of a rather wide variety of responses whose typical age of appearance is known from normative studies. Whether the infant's performance or behavior approximates, exceeds, or falls short of what would be expected for his chronological age is indicated by his "Developmental Quotient" (ratio of developmental age to chronological age). In some instances these tests provide separate estimates of developmental status for broad areas such as motor, adaptive, language, and social behavior, although it is not at all clear that these are really distinct and homogeneous scales.

Infant tests of the sort just described offer a number of important advantages, but they suffer from several disadvantages as well (Stott, 1965). On the positive side, they have a long history of wide use in a variety of studies of early development, so that if carefully administered they may provide data having a reasonable degree of comparability across studies. At the same

time, although it is well known that infant tests have only limited value in predicting later intellectual development throughout the broad range of intellectual variation, they are capable of revealing gross or severe developmental deficits in important areas of adaptive functioning which may be of considerable predictive significance with respect to subsequent development (Knobloch, and Pasamanick, 1960; Illingworth, 1961). Moreover, a recent study revealed that the predictive value of low developmental test scores is considerably greater for infants in lower socioeconomic groups (where malnutrition is likely to be prevalent) than in middle or upper class groups (Willerman, 1970).

Many of the difficulties involved in the use of infant tests to assess intellectual development, particularly in diverse cultures, are quite familiar to researchers in the field. There is for example, the problem of adapting the test procedures, content, and language to make them culturally appropriate for the population being studied. (This is not as much of a problem in the first year, when major emphasis is on sensory-motor, manipulative, and orienting responses.) There is also the related problem of culturally appropriate norms, although the use of carefully selected control groups from the same general environment as the malnourished subjects makes the availability of such norms much less crucial, and provides other methodological advantages as well. Although it is possible to achieve reasonably high test-retest and inter-examiner reliability in infant testing (Werner and Bayley, 1966), it is important to ensure appropriate training of examiners in standard procedures, particularly in testing for social and interpersonal responses.

Another difficulty with the use of infant tests in research on malnutrition is that because of their rather global content, which varies considerably with age level, they provide relatively little information about specific cognitive, learning, or other psychological functions which might be affected. Moreover, as previously indicated, performance on these tests before the age of three, bears only a limited relationship, generally speaking, to intellectual status during school-age years and thereafter.

A final comment has to do with the fact that performance on infant tests is rather sensitive to marked inadequacies in experience and social environment even in the first 18 months of life (Dennis, 1957; Provence and Lipton, 1962; Yarrow, 1964), although variations associated with ordinary social class differences do not appear consistently until age two or three (Bayley, 1965).

While this sensitivity of infant tests to variations in the social environment is an advantage if one is interested primarily

in the effects of early experience, it raises added difficulties of research design for the investigator concerned with isolating the influence of nutritional deficiencies on psychological development.

Several efforts have been made in recent years to develop and standardize infant tests of cognitive development which assess some of the more formal cognitive structures in the infant's repertoire, as derived from Piaget's formulations (Corman and Escalona, 1969; Pinard, 1964; Uzgiris, 1966). While the "practical" validity of these scales is not yet clear, they represent valuable approaches both because they deal with well defined, theoretically relevant cognitive functions in infants, and because the measures obtained may be somewhat less susceptible to variations in recent experience than is the case for the standard infant tests (Kohlberg, 1968). Among the general infant tests currently available, the recently revised and restandardized Bayley Scales of Motor and Mental Development (1-15 months) appear to represent a very promising instrument for use in research on early effects of malnutrition (Werner and Bayley, 1966; Bayley, 1965).

OTHER PSYCHOLOGICAL FUNCTIONS AND OUTCOMES WORTH ASSESSING

There are a number of conceptually relevant, important psychological functions which could profitably be assessed at this point in our research on nutritional influences on infant behavior (even though their "practical" relevance in terms of social competence may not yet be well demonstrated empirically). One of the main advantages of incorporating measures of these specific processes in our investigations is that they offer a greater possibility of delineating the particular behaviors and processes influenced by malnutrition than is the case if we depend primarily on more global measures such as the infant tests. It should be possible to adapt existing procedures for assessing the functions to be discussed in a variety of local settings, with appropriate methodological development and pretesting. (An approach along these lines is being followed by Klein and his collaborators (1969) in the INCAP studies in evaluating learning, memory, etc., in pre-school aged children.)

The paragraphs which follow, briefly outline a variety of perceptual-cognitive and learning functions, attentional and motivational processes, and social-emotional behaviors, which would be well worth investigating in studies of infant malnutrition.

Perceptual-cognitive and learning functions.

Complex perceptual discriminations.

Recently developed methodological procedures permit the assessment of rather complex discriminative responses in infants

even during the first year of life. These responses include visual depth perception, perception of shape and size constancy of objects, differentiation of paralinguistic features of the human voice such as intonation and contour, etc. (Gibson, 1969).

Recognition and memory.

There has been much recent research interest in analyzing the infant's capacity to "store" and utilize information of varying degrees of complexity, so that recognition of familiar objects and their representations is possible, unfamiliar objects are seen as such and may thus generate interest and attention, and learning of various kinds is facilitated (Charlesworth, 1968; Uzgiris, 1970).

Generalization and abstraction.

Techniques are available for evaluating infants' capacity to identify or extract "essential" similarities in objects or stimuli despite variations or transformations in less salient characteristics (Gibson, 1969; Reese, 1970). Such processes represent an essential part of the gradual development of abstract thinking and concept formation.

Primitive categorizing or object sorting behavior.

The child's capacity actively to group or sort objects on the basis of relevant similarities and differences has long been recognized as an important index of conceptual thinking (Flavell, 1970). Recently developed procedures permit assessment of early forms of such behavior in infants as young as 12 months (Ricciuti, 1965). Substantial differences in object grouping between marasmic and normal infants have been found in a recent study employing these techniques (Brockman and Ricciuti, 1971).

Prelinguistic vocalizations and early language behavior.

A more thorough and systematic analysis of early language behavior and development in malnourished infants would certainly seem very worthwhile, even though language comprehension and production are very much influenced by variations in experience, particularly after the first year of life (Ervin, 1966; Reese and Lipsitt, 1970). A number of studies suggest that language behavior may be particularly vulnerable to early and severe malnutrition (although experiential influences cannot be ruled out), (Cravioto and Robles, 1965; Chase and Martin, 1969). It would be particularly valuable to obtain more precise descriptions and analysis of prelinguistic vocalizations of malnourished infants during the first year of life (including babbling and cooing) since these behaviors are regarded as being largely biologically or maturationally determined (Lenneberg, 1967). Moreover, recent

research suggests such vocalizations are correlated substantially with IQ measures during adolescence and later, at least in girls (Cameron and Bayley, 1967).

Learning processes.

One of the most rapidly expanding and fertile areas of recent infant research has been the analysis of learning functions and learning capacities in infants (Reese and Lipsitt, 1970; Horowitz, 1969; Lipsitt, 1967). Increasingly refined methodologies have been developed permitting the investigation of classical and instrumental conditioning, as well as discrimination learning in infants as young as the neonate. With these procedures, it has been possible to demonstrate rather surprisingly complex learning performances in infants. The importance of systematic investigations of these processes in malnourished infants seems obvious and is further reinforced by the promising results being obtained in animal studies dealing with malnutrition and learning (Barnes, 1969; Levitsky and Barnes, 1970). A closely related problem is the influence of variations in arousal, responsiveness, and emotionality upon infant learning (Horowitz, 1968; Ricciuti, 1968).

Attentional and motivational processes.

While functionally closely intermeshed with the perceptual-cognitive processes previously outlined, the behaviors to be discussed here reflect various aspects of the manner in which the infant selectively responds to or becomes interested in environmental stimuli. In a sense, these processes may be regarded as representing important motivational "sub-structures" underlying much learning and intellectual growth. In view of the many clinical observations of apathy or listlessness as well as irritability shown by malnourished infants, systematic studies of arousal and responsiveness in these children would certainly seem to be extremely important. Recent studies of these behavioral characteristics in malnourished animals supports this proposition (Levitsky and Barnes, 1969).

Habituation-dishabituation.

Response habituation to repeated stimuli and the capacity to energize responses anew when the stimulus has changed (dishabituation) have long been recognized as adaptively important functions in animals and man (Thorpe, 1963). Moreover, recent research suggests that individual differences in habituation, or "response decrement," may reflect significant differences in rates of cognitive growth in human infants in the first year of life (Lewis and Goldberg, 1969). Capacity to habituate to repeated

stimuli also appears to be sensitive to central nervous system impairment (Eisenberg, Coursin, and Rupp, 1966; Thompson and Spence, 1966).

Orienting responses, "surprise" reactions.

It would be valuable systematically to assess the nature of simple orienting or "alerting" responses in malnourished infants, to determine how readily such responses can be evoked, and how adaptive they are in the light of the particular stimuli involved (Lynn, 1966). Perhaps a more important issue is the determination of the infants' capacity to show "surprise" or heightened attentional responses when confronted with a situation involving a discrepancy between expected and actual stimulus events (Charlesworth, 1969; Kagan, 1969; McCall and Kagan, 1969). Such reactions require both a perceptual-cognitive awareness of the discrepancy, and the energizing of sufficient arousal or attention to support continued attempts to deal adaptively with the stimulus discrepancy (Hunt, 1965).

Exploratory behavior and curiosity.

Well developed procedures exist for assessing these obviously significant aspects of behavior in infants, particularly when some degree of mobility and locomotion has been achieved (Berlyne, 1966; Ainsworth and Bell, 1970).

Social and emotional behavior.

Some of the behaviors already referred to in the preceding section may be regarded as reflecting a variety of emotional responses. In addition, however, systematic evaluations of the nature of malnourished infants' negative emotional responses, such as fear, distress, and anger, as well as their capacity to mobilize positive emotional responses would be very valuable, particularly if made at various points during treatment and recovery from acute nutritional illness. (The prognostic significance of the appearance of smiling behavior during treatment is well known clinically.) Currently, increasing attention is being directed generally both to the question of the functional significance of these emotions in infancy (Ricciuti, 1968), as well as to procedures for assessing them more precisely (Scarr and Salapatek, 1970).

Closely related to the emotional responses just mentioned is the matter of the social behavior and social relationships of the malnourished infant. While the pattern of social attachments to adults and other children formed during the first several years of life is very much a function of the social environment and experience of the infant (Rheingold, 1966; Maccoby and Masters,

1970), it would be useful to know more about the manner in which the physical and behavioral consequences of malnutrition might limit the infant's capacity to respond socially to others, and at the same time influence the social responses of adults and other children to him. Such potential influences would have significant implications not only for the infant's social and personality development, but also with regard to the nature of the environmental stimulation available to him as a facilitator of intellectual development.

SOME ADDITIONAL GUIDELINES FOR THE ASSESSMENT OF BEHAVIORAL AND PSYCHOLOGICAL DEVELOPMENT IN MALNOURISHED INFANTS

1. There are important advantages to be gained by assessing malnourished infants' behavior during nutritional treatment, recovery, and rehabilitation, particularly if we are to distinguish between immediate, short-term, and long-term effects, and to trace the patterns of behavioral recovery. A related point is that performance on many of our infant assessment procedures is very much determined not only by the infant's "capacity" but by factors such as responsiveness, motivation, or emotional state. If we are interested in evaluating the infant's competencies, therefore, it is particularly important to assess his behavior under near-optimal conditions permitting ample time for adaptation to the test situation, etc.

2. In addition to assessing malnourished infants' behavior and performance during relatively brief examination periods at various points in time, it would be of considerable value to evaluate the infant's responses to short-term, systematic programs of training or practice aimed at facilitating learning or growth in particular behavioral areas. This issue is closely related to, but not identical with, the broader consideration of incorporating both long-term nutritional intervention and environmental enrichment in the design of prospective studies.

3. If we are to better understand the mediating processes through which malnutrition influences infant behavior and psychological development, it is particularly important that we employ measures of a variety of specific psychological functions, as was suggested earlier in the paper, so that the differential effects of malnutrition upon these functions, and upon their interrelationships, can be examined more carefully. In the long run, our understanding of mediating processes will be greatly facilitated by analyzing interrelationships among behavioral, biochemical,

and neurophysiological measurements, an approach being utilized in several current research programs.

4. The majority of behavioral assessments typically made by psychologists are carried out in standard testing or laboratory situations. It would be very unwise, however, to limit our behavioral measures to such situations, when so much qualitative and quantitative data of great value can be derived from systematic observations of malnourished infants' behavior in "natural" settings of various kinds. Such observations would be particularly useful in providing information concerning infants' exploratory behavior and curiosity, emotional responses, and social behavior. An added benefit of including observations of infants in their natural settings is that one is constantly reminded of the importance of assessing variations in specific aspects of the social environment which influence the infant's behavior. (Recent methodological advances make it increasingly feasible, for example, to obtain systematic descriptions and analyses of naturally occurring adult-infant interactions [Caldwell, 1968; Moss, Robson and Pedersen, 1969]).

Isolating Influence of Malnutrition from that of Related Social Environmental, and Biological Factors, and Determining How These Two Major Influences Interact in Jointly Affecting Psychological Development

The problem just stated represents a central, well-recognized issue which has been discussed at length in several recent conferences and papers (Ricciuti, 1970; Richardson, 1968; Pollitt, 1969); hence, it will be discussed only briefly in the present report. It is obvious that most of the previously described behavioral measures of psychological development in infancy are susceptible, to varying degrees, to the adverse influence of a variety of social, environmental and biological inadequacies (other than postnatal malnutrition) which are typically associated ecologically with malnutrition itself. This has made it very difficult to draw from our research thus far clear, firm conclusions concerning the casual role played by malnutrition as an independent determinant of impaired psychological development.

To take just one brief example, consider the problem of low birth weight or prematurity. In a number of studies of infants hospitalized for severe malnutrition during the first year or two of life and found to have substantially reduced DQ's or IQ's shortly thereafter or later in childhood, it is difficult to determine to

what extent the development of these children might also have been impaired because of low birth weight (Cravioto and Robles, 1965; Pollitt and Granoff, 1967). Investigations of prematurity consistently report lower DQ's or IQ's even at ages six or seven for children with birth weight below 2500 grams, particularly in lower socio-economic groups (Drillien, 1964). Moreover a recent study indicates that these reduced levels of intellectual functioning are no less marked for low birth weight infants whose weight is "normal" for their gestation age (Wiener, 1970).

Our major methodological concerns, then, include not only improved assessment of cognitive, social, and other relevant behaviors in malnourished infants (the major concern of the present paper), but more careful specification and measurement of those components of the social-materiel environment of the infant, as well as related biological factors, which are capable of exerting substantial effects on psychological development. Beyond this, the primary problem then becomes that of designing investigations with the kinds of controls and comparisons which permit inferences to be drawn concerning the manner in which malnutrition operates independently and/or interactively with other social and environmental influences in shaping the course of early development.

It appears to a good many people that it is virtually impossible to accomplish this aim in studies which rely heavily on data and information which are essentially retrospective in nature, as is the case in many investigations of the intellectual status of children of various ages with known or presumed histories of early malnutrition. There is considerably greater likelihood of our achieving a fuller understanding of the effects of malnutrition, and of the socio-environmental influences typically associated with it, through detailed prospective or longitudinal studies. These include both the ecologically oriented, non-experimental investigations, and those which involve systematic comparisons of the effects of nutritional intervention, and of environmental "enrichment" or stimulation, upon the development of malnourished infants and children. It is particularly through the last-mentioned research strategy, which is being incorporated increasingly into the design of contemporary research on malnutrition, that our greatest gains are likely to be made.

Given the aforementioned difficulties of research design and interpretation which are often difficult to avoid due to the nature of the problem, a recent detailed review of the research literature (Ricciuti, 1970) led to the following summary conclusions regarding the influence of malnutrition on mental development:

"First, there is reasonably good evidence that protein-calorie malnutrition occurring in the first year of life, which is severe enough to markedly impair physical growth and to require hospitalization and treatment, may have adverse effects on the child's mental development, perhaps even to the extent of producing in some instances borderline or more severe mental retardation which does not appear to be readily remediable under conditions of nutritional rehabilitation. Severe malnutrition beginning in the second year of life or later, often taking the form of kwashiorkor, appears to produce adverse effects on mental development which are not as severe and seem to be more amenable to treatment. In both instances, however, it is not entirely clear whether the condition of postnatal malnutrition is the sole or even principal determinant of impaired intellectual functioning, nor do we fully understand how its influences are mediated.

Secondly, when we consider the chronic, moderate-to-mild protein-calorie malnutrition which appears to be endemic in many economically disadvantaged populations, then the evidence as to effects on intellectual and learning functions attributable to malnutrition as such, independently of the concomitant influences of social and environmental factors, is very weak and unclear indeed, and we need considerable further research on this question before it can be satisfactorily answered. It's reasonable to assume, however, in the light of our present knowledge of child development, that the effects of moderate or mild malnutrition on intellectual development and school learning are probably minimal, in comparison with the influences attributable to other major environmental, experiential, and genetic determinants of mental development."

Whether our research will enable us to arrive at more definitive conclusions than those just summarized depends in a large part upon our successfully improving all aspects of our research methodology and strategy, and carrying out carefully replicated studies employing these strategies.

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NUTRITION AND THE COMMUNITY

by

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Introduction

Theories confirming the obvious have great appeal due to their simplification of complex relationships and frequent surface validity. The idea that undernutrition causes mental retardation is one of these theories. Malnutrition, defined hereafter to mean undernutrition, is associated with a number of negative consequences including smaller size, higher infant mortality rates, and increased incidence of infectious disease. However, a causal role in mental retardation remains unproven. Although a number of studies have examined the intellectual performance of children malnourished early in life, the resulting correlations do not explain the social or psychological mechanisms attributed to malnutrition. In this paper, I suggest that social class and genetic influences on behavior may also lead to results usually attributed to malnutrition, and that the social consequences of the physiological mechanisms involved in malnutrition may explain many of the relationships which exist.

While animal experiments support the idea of a relationship between nutrition and intellectual performance, the human situation is complicated by the fact that nutrition is not randomly distributed in the social system. A variety of factors which may have a negative influence on intellectual and social development appear more frequently in those groups in society in which malnutrition is more apt to occur. Hence, studies which compare differences in the intellectual status of well nourished and malnourished individuals in the same community are inevitably confounded by the interaction between nutrition and social class.

These interactions have been documented in a number of studies. Stoch and Smythe's (1967; 1968) pioneering study of well and malnourished African children demonstrated that the malnourished children came from families in which there was poorer housing, greater unemployment, more alcoholism, and more

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broken homes, although both groups reportedly came from the same lower-class segment of society. Cravioto and De Licardie (1966), in their study of the relationship between intra-sensory organization and nutrition as measured by childrens' height, reported that "when the mother's educational status was below the median for the sample of mothers studied, the likelihood was greater that her child would be of short stature." (However, they failed to find a relationship between other social factors and nutritional status). (Cravioto and De Licardie, 1968, p. 263). Monckeberg (1968; 1969) has shown a relationship between social class and nutrition in Chile, as have Ramos-Galvan, *et al*, (1968) in Mexico. More importantly, Ramos-Galvan, *et al*, have shown a relationship between social class, urban or rural residence, and intellectual development. Chase and Martin (1970), in their study of children hospitalized for undernutrition prior to one year of age, showed that these children, when compared to a control sample, came from homes with a greater degree of disorganization, greater financial problems, etc.

Malnutrition during the period of growth will result in an adult who is smaller than the non-malnourished adult. While some catchup growth may occur with nutritional rehabilitation, the usual situation is for the nutritional inadequacy to impair physical growth. This impairment is also often associated with a delay in sexual and skeletal maturation (Scrimshaw and Gordon, 1968, part 4).

At the same time, there exists a synergism between malnutrition and infectious disease. Poor nutrition appears to reduce resistance to infectious disease which in turn places an increased metabolic load on the individual and reduces the ability of the body to utilize available nutrients while creating a need for increased nutritional intake to maintain metabolic balance. In many areas this situation is exacerbated by a heavy parasitic load. This synergism helps to account for the high infant and preschool death rates in areas of high malnutrition (Scrimshaw, *et al*, 1968).

Accumulating evidence shows that, among humans, there is some correlation between malnutrition and intellectual incapacity, although the causal relationships are not clear. The relationship is better documented for severe than for mild or moderate malnutrition. Among the severely malnourished, by which is meant those who suffer during childhood from marasmus or kwashiorkor, both physiological and social factors can be implicated in the relationship (Chase and Martin, 1970; Stoch and Smythe, 1967; 1968; Kallen, 1971). Among those who suffer from milder forms of malnutrition, defined as sufficient to reduce adult physical size without threatening life, there is some

evidence that malnutrition is associated with specific types of intellectual impairment, but causal relationships are unknown (Klein, *et al*, 1970).

The physiological state which results from lack of sufficient or appropriate nutrients must be separated from the psychological and social status of populations who are malnourished. The physiological lack in which sufficient nutrients of the proper types are not ingested or utilized by the individual is properly termed malnutrition. The psychological state which exists when the available nutrients are not satisfying to the individual is termed hunger. While it is theoretically possible to be hungry without being malnourished and malnourished without being hungry (Kallen and Howell, 1970), the two are often found together.

The foregoing briefly summarizes our present knowledge of the relationship between malnutrition, hunger and the human community. At the present time, there are many unanswered questions regarding the mechanisms and processes through which intellectual and social development, nutrition, and societal factors are interrelated. The remainder of this paper is an attempt to clarify these relationships. An examination of the evidence may help to explain the causal mechanisms involved and, perhaps, to point to directions of research which may or may not validate these ideas. I want to make it very clear that what I have to say from here on is *highly speculative* and that there are some significant gaps in evidence and perhaps in reasoning.

Social Environments and Malnutrition

I have suggested that malnutrition is not randomly distributed in the social system. Jessor and Richardson (1968) have suggested the utility of distinguishing the distal and the proximal social environment. By distal environment they mean the regularized social relationships that tend to group individuals into strata in the larger society. Individuals in given strata tend to behave in ways that are similar to each other and different from individuals in other strata. Thus, a knowledge of relationships in the distal environment will provide guidance for the location of certain kinds of behaviors or relationships in the social system.

This locational predictability does not provide much information about the mechanisms through which behavior arises and is maintained. Knowing that members of a particular class have characteristic X may help explain the behaviors of members of that class, but does not explain why X is more frequent in that class. The specific interactions and relationships among members

of that class which mediate between the distal environment and behavior is termed the proximal environment.

When I suggest that nutrition is related to the social structure, I am referring to relationships in the distal environment and specifically to the social stratification system. Stratification includes an indication of access to scarce goods and services, including food. From one point of view, the absolute access to the rewards of the society is important, particularly when one social strata receives goods and services which permit survival at only a bare subsistence level. But from another point of view, it is the relative position within the society which is the important determinant of behavior. Thus, access to goods and services which in one society are available only to the middle or upper class will, in another society, be available to the lower class.

A group in society may regard the unequal distribution of goods and services as legitimate or they may regard themselves as relatively deprived (Shils, 1950). If they are relatively deprived, they perceive themselves as receiving less than their fair share of those things their society values. Relative deprivation, then, indicates the extent to which members of a strata believe certain goods and services *should* be available to them. It may also depend on the extent to which either the deprived group or the gatekeepers of the society view the lack of access as stigmatizing.

This is one of the reasons why it becomes important to speak of the hungry as well as of the malnourished. Malnutrition is basically a physiological entity in which an individual or a segment of society does not receive sufficient nutrients to sustain health or normal development. Hunger represents a psychological response to a physiological drive. It is the response to internal signals regarding the metabolic equivalent of an empty stomach. It may exist for a whole group or population, as in times of famine. But it may also exist when certain segments of the society are denied access to kinds of foodstuffs (and to other social resources) available to some in the society, and to which the denied group feels it has a right. In such instances, hunger involves socially structured and individually perceived deprivation. Both hunger and malnutrition are most apt to be found among those segments of the population whose roles in the productive system are easily replaceable, convey little prestige or status, and receive few rewards; i.e., the lower class of the particular social system or sub-system involved.

Recognizing the existence of a social stratification system in which different levels have differential access to goods and services does not provide us with much information on the mechanisms through which social class differences in behavior occur. While life conditions explain some of the behaviors characterizing

individuals in different social positions, the mechanisms of the social system are not well enough known for us to posit with any degree of certainty that being in a given social position will inevitably lead to certain styles of behavior, child-rearing practices, and so on. Factors in the proximal environment must be examined to explain regularities found in the behavior of different social groups. Hence, social class may be described as a membership group with a life style of learned behaviors which reflect the personalities and needs of the members of that class or group. Conversely, the behavior of individuals with a particular life style may explain the mechanisms in the proximal environment which influence behavior.

Finally, social classes may be regarded as genetic pools and breeding groups in which a combination of social mobility based on socially valued characteristics, assortative mating, and differential reproduction and survival leads to a differentiation of the genetic potential of the various classes within the society (Eckland, 1967). In smaller communities with limited geographic mobility, inbreeding may also be an important influence on genetic endowment within the community.

What does this have to do with nutrition? I suggest that it is only through looking at the social stratification system with its influence on access to scarce resources, at life style, and at genetic potential that a full understanding of the relationship between malnutrition and performance can be achieved. Thus, relationships in the distal and proximal environments will be shown both to influence and to interact with nutritional status in producing outcomes.

Malnutrition and Intellectual Performance

Next, we need to look at the relationships between nutritional status and intellectual performance which have been reported in the literature. In almost every instance, the malnourished child has been reported to have a lower level of performance on whatever test of intellectual capacity was used as compared to well nourished children. Furthermore, there appears to be a meaningful pattern of results.

Many studies of infants hospitalized with severe malnutrition (kwashiorkor or marasmus) report a greater deficit in language than in other areas of development* (although all areas show a developmental deficit). (Chase and Martin, 1970;

*Severe malnutrition early in life may produce irreversible deficits in brain development in both humans and animals. (Winick, 1968; 1969; Winick and Rosso, 1969; Monckeberg, 1968; 1969).

Monckeberg, 1968; 1969; Stoch and Smythe, 1967; 1968). It seems possible that a major portion of these deficits are a direct consequence of the lack of stimulation and decreased interaction with significant others which occur as a consequence of the hospitalization experience. The apathy which characterizes the severely malnourished infant would tend to make him less receptive to the available stimulation, and the hospital situation often tends to lack appropriate stimulation. At the same time, there is apt to be a reduction in the consistent verbal and other forms of interaction with stable others which are required for adequate language development.

Studies of children who have been malnourished without requiring hospitalization also report significant lowering of abilities. Reports by Klein, *et al.*, (1969) and by Sulzer (1969) are particularly informative. Klein, *et al.*, compared the performance of Guatemalan children who had been rehabilitated from malnutrition in day care centers with children from the same social setting who were never malnourished. Using a variety of tests, they report results consistent with the interpretation that the malnourished children "do not develop the set to invest sustained attentional involvement in difficult cognitive tasks" and are less motivated to perform. Sulzer, in a study of head start children in the United States, found that those with anemia as defined by low hemoglobin or low hematocrit had a lower learning ability than head start children without anemia. The patterning of his results, although not totally clear, suggests that the anemic children were characterized by a less sustained level of motivation and by a lower energy level. In the Guatemalan study, practice and an opportunity to become involved in the task resulted in the malnourished sample's improved performance.

Other Influences on Intellectual Performance

These relationships between nutrition and intellectual performance parallel those for social class. Coleman, *et al.*, (1966) suggest that the poorer school performance of lower class groups in the United States is in part a consequence of lack of motivation which stems from the failure of the family to support academic achievement. The lower motivation to perform which characterizes these children is probably mediated by events in their proximal environment.

Whiteman and Deutsch (1968) have shown that certain kinds of stimulation which occur in some homes and not in other homes of the same social class level have an effect on language development, and hence on intellectual performance as measured

by the common intelligence tests. Specifically, such things as the amount of dinnertime conversation and the extent to which the family exposes the child to cultural events, effect performance on tests of verbal intelligence. Strodtbeck and Greelan (1968), in a review of the studies of the relationship between family size and intelligence, suggest that one of the reasons larger families have less intelligent children is a lack of sufficient adult-child interaction to stimulate verbal development. The availability of differentiated perceptual stimuli early in life is also an important component of intellectual development. Later learning builds on initial opportunities and stimulation, thus accounting in part for differences in measured intellectual performance during later childhood and adulthood.

Interaction, Stimulation, and the Development of the Self

So far, we have seen only part of the picture. Development takes place in an interactive frame; from birth the infant interacts with the environment and with important individuals within the environment. If the physiological condition of the individual is such that he does not perceive or respond to the stimulus which is presented to him, then the required learning base is not laid down and the initial potential with which he enters the world will not be manifest in his later behavior.

The malnourished infant or child tends to be apathetic, passive, and fussy, as is the neglected or unstimulated child. Thus, the consequences of the physiological condition of the child which results from poor nutritional status may mimic that which occurs in a low stimulus environment. With this lack of stimulation, created in this instance by the inability of the child to perceive or respond to it, an inhibition of intellectual development occurs. Even with the mildly malnourished child—or the hungry child—the anxiety and concern over food may utilize significant amounts of energy and attention, thus reducing his attention to learning tasks.

This assumes additional importance for the malnourished child because of long-range effects on personality and motivation. The lack of performance motivation hypothesized by Klein, *et al*, (1970) to account for the poor results obtained by malnourished children on tests which involve difficulty or a short presentation of the stimulus, may have a social psychological explanation. The self develops in interaction with significant others (Cooley, 1909; 1922; G. Mead, 1934). An individual's perception of himself develops only as he perceives the responses of others towards his own behavior. One sees oneself only in the mirror of the

responses of significant others. A strain for self-consistency develops early in life, with the self protecting itself through interpreting the behavior of others in ways which are consistent with the developing perception of one's own self. If one's experience with others leads to a low evaluation of one's own abilities, then one defines oneself as inept. For the malnourished child who has been passive, apathetic, and fussy, and whose life has been interspersed with episodes of infectious disease, there is a high probability that the responses of significant others to him will confirm his picture of himself as less able. It seems quite possible that the experiences he has had will, in fact, demonstrate that he is less able, partly because of the interference created by apathy and lack of energy. In addition, a failure to learn certain developmental tasks early in life may create a situation where the tasks presented to the individual are continually beyond his ability, and he never has the opportunity to catch up. This situation can lead to a sense of being lost in a world one does not understand and a sense of discouragement or fatalism about the future. It can result also in an unwillingness to attempt difficult tasks because of the assumption that one will fail.

Self-Fulfilling Prophecies

The system takes on two aspects of a self-fulfilling prophecy (Merton, 1957). In the first place, the level of aspiration of the individual will drop to the point where he is unwilling to attempt difficult tasks. As early studies of the level of aspiration conducted by Lewin and his students point out,

level of aspiration shifted directly with the level of performance; an experience of success gave rise to a higher level of aspiration on the next attempt. One success after a series of failures, however, was generally not enough to affect the factors in goal-setting behavior that influenced the decision to raise the level of aspiration. Upon failure, the level of aspiration was generally lowered or the action discontinued (Marrow, 1969, p. 251).

Thus, objective success or failure, as well as the responses of others, will tend to become integrated into the self system. If the child has constantly experienced failure, as seems probable for malnourished children, then not only does he define himself as inept, but also he lowers his level of aspiration and, as a consequence, his level of effort.

The other half of this self-fulfilling prophecy comes from the responses of significant others to the individual. The expectancies which others have of level of performance have a significant influence on that performance regardless of the individual's absolute level of ability. While the mechanisms by which these expect-

tations are transmitted to, and effect the performance of, the individual are not clear, they seem to be rooted in differential behaviors of the significant other (Rosenthal and Jacobsen, 1968a; Meichenbaum, *et al*, 1969). Since the self behaves in self-consistent ways, these expectations have a greater effect on younger than on older children, and it is particularly during these younger ages that children are more apt to be influenced by the expectations of the others (Rosenthal and Jacobsen, 1968b). Not only do infants respond to the attitudes and emotions of their mothers, but mothers respond to the responses they get from their infants. The infant who is unresponsive is therefore likely to elicit different and probably less stimulating responses from his mother and from other significant people in his life.

In many instances, malnutrition is apt to commence after the first six months of life and is often associated with the weaning period. This period, when the infant starts to explore his environment also becomes the time when he is most apt to be exposed to infectious disease and, in areas where sanitation is problematical, parasites. This is also the period when expectations concerning his behavior begin to evolve—expectations concerning his ability, responsiveness, and the extent to which he has characteristics regarded as desirable within the society in which he will live. These expectations, again, are communicated to the infant through the way in which others respond to his behavior.

Pollitt (1969) has suggested that in societies where malnutrition is endemic, expectations concerning the behavior of malnourished infants will be different from societies where malnutrition tends to be exceptional. In the first societies, the apathetic and nonresponsive behavior of the individual will be normal and will not necessarily place him on a deviant socialization track. In societies where malnutrition is exceptional rather than endemic, the lack of responsiveness of the malnourished infant will label him as deviant. This labeling as deviant will result in stigmatization and differential treatment (Simon and Gagnon, 1967). It is possible that the labeling of the child as malnourished will become *the* important thing about him to which others respond. The labeling phenomena will perpetuate the stigmata of being malnourished, inept, or incapable. This, in turn, will confirm the self-image of the child and will perpetuate his behaving in ways which confirm others', as well as his own, perception of his deviance and/or lack of ability.

Genetic Influences—A Speculation

At the same time, the possibility that the lower intellectual capacity of malnourished children is a consequence of genetic en-

dowment cannot be overlooked. Monckeberg (1969) reported that among his urban samples, there was a positive correlation between the nutritional status of children and the intelligence of their mothers. There is also a correlation between the intelligence of the children and their nutritional status. Therefore, there is a possibility that the reported correlation between nutrition and intellectual development is at least in part a consequence of genetic inheritance, where the lesser intellectual ability of the parents leads to both malnutrition and lower intelligence among the children.

The relationship between genetic endowment and measured intelligence has recently become an area of great controversy, in which there is more heat than light. Involved in these discussions are questions about the nature of intelligence, the meaning of those things which are measured by intelligence tests, the effects of facilitative or suppressive environments on intelligence, test performance, and other behaviors, and the relationship between membership in a given racial group and genetically determined intelligence. Most of these issues will not be dealt with in this paper, although they are all important to a full understanding of the possibility that some of the lowered intellectual performance of malnourished children is a consequence of their genetic inheritance.

At the outset of this discussion it is important to point out that while the evidence for heritability of intelligence for individuals is impressive, I do not believe there is any evidence to support the position that there are racial differences in genetically determined intelligence, and, given the effects which environment can have on measured intelligence, there is presumptive evidence against this position.

Burt (1972) has summarized a lifetime of work on the nature of intelligence with the following statement:

The two main conclusions we have reached seem clear and beyond all question. The hypothesis of a general factor entering into every type of cognitive process, tentatively suggested by speculations derived from neurology and biology, is fully borne out by the statistical evidence; and the contention that differences in this general factor depend largely on the individual's genetic constitution appears incontestable. The concept of an innate, general cognitive ability, which follows from these two assumptions, although admittedly a sheer abstraction, is thus wholly consistent with the empirical facts. (p. 188)

Eckland has summarized a number of studies of the relationship between genetics and intelligence, pointing out that in the studies reviewed:

roughly 70 percent of the variance within families in intelligence has been attributed to genetic heredity. Moreover, the findings have been remarkably consistent despite differences in the types of intelligence tests, differences in the age structure, ethnic composition, or socioeconomic character of the samples, differences in the regions studied, i.e. whether local, national or foreign, and differences in sample size, which have been unusually large in some cases. (p. 178)

Studies of adoptive children have shown that the correlation between the IQ of the children and the education of their natural parents, while moderate to low, is greater than the correlation between the children's IQ and the education of their adoptive parents (McClern, 1964). Jensen (1969) has reached the same general conclusion about the inheritance of intelligence, without, however, restricting his generalizations to within family or individual intelligence. At the same time, the predictions made of a child's intelligence on the basis of parental characteristics, are far from perfect, indicating both a regression towards the mean and the impact of environment on the expression of that genetic ability.

Gottesman (1968), McClern (1964) and Eckland (1967) all point out that the expression of the same genetic characteristic can differ markedly depending on the environments. Scarr-Salapatek (1971) reports that existing data in the United States are consistent with the interpretation that suppressive social environments reduce the measured attainment of genetically determined intellectual potential among Negroes in the United States. Similar environmental suppressors may reduce the measured intellectual performance of malnourished children in Latin America. At the same time, if these children are less intellectually able to begin with, (i.e., if their genetic potential is lower than it is for well nourished children), the restricted nature of their social environments may serve to lessen even more the probability that they will reach the capacity they do have.

There is also some evidence to indicate that social classes tend toward some degree of homogeneity of intelligence when there are no artificial barriers to mobility such as exist for the American Negro. Social mobility, when not artificially restricted, provides opportunity for the more intelligent to move upwards in the system and, at the same time, is apt to create a downward movement of the less intelligent born into families in the middle or upper classes. In the United States and other industrialized countries, occupational position is highly related to education, and education is highly related to intelligence. Thus, mobility may increase the intelligence differentials between social classes.

Social class may also represent a breeding population in which the genetically determined intelligence of persons within

the class is more similar than cross-class intelligence. At least two mechanisms support the idea that people of similar characteristics will tend to marry each other. Eckland (1967) reports that in the United States "the education of two spouses accounts for far more of the variance in mate selection (and has for at least 30 to 40 years) than any other known factor" (p. 181, note 30). In societies where intellectual performance is one of the major attributes which determines the desirability of an individual, intelligence becomes a major basis for association. This is partly a consequence of the different settings in which individuals tend to move, with contiguity being one of the primary determinants of mate selection. In the United States, college is one of the primary meeting grounds for this selection, and intelligence permits access to the college setting (Elder, 1969a; 1969b). Thus, the better educated girl from a lower class background, that is, the lower class girl who has both the intelligence and the drive to attain a college education, is placed in a setting where she is more likely to come in contact with middle and upper class males who are potential husbands. Because exchange theory suggests that, for males, the physical characteristics of the female (at least in North America) have a social value, physical endowment can substitute for education. For males, Elder has shown that achievement motivation in adolescence is one of the prime requisites for upward mobility.

Although I know of no studies of the relationship between intelligence and mobility in Latin America, it is not unreasonable to assume similar mechanisms are at work. In a marginal economy where the difference between severe malnutrition and marginal malnutrition may depend on minor differences in income or access to food, those who are better endowed intellectually may well have an advantage in the struggle for survival. Small economies in food, ability to earn slightly higher wages, or greater drive for achievement may make a significant difference in the probability of the individual's or the family's becoming malnourished. I suspect the impact of these differences may be even more important among recent migrants to urban areas from rural villages for whom survival in the urban environment depends on the ability to learn the norms and the ways of the city if they are to achieve some edge in the struggle for survival. Sussman (1969) has suggested that the ability of recent migrants to survive in the urban environment is related to their competence in dealing with a series of bureaucracies and other formal organizations. This success depends in part on learning new ways of behaving, and on assuming new roles and new life styles. Clearly, this is not unrelated to the intelligence of the migrant. Further, through time, those who achieve some level of success in the adaptation to the

new urban environment will have a greater probability of moving out of the lowest level in the society. Those who survive marginally will remain at the lower reaches, with upward mobility impossible. It is this group which, perhaps as a consequence of the failure to adapt to the new requirements of the urban condition, will be at greatest risk for malnutrition.

There are several problems in the attempt to assign a large degree of genetic determination to the lower intelligence of the malnourished. The first of these, of course, is that social and psychological conditions in which malnutrition is found, as indicated earlier in this paper, are sufficient to inhibit the full development of the individual's genetic endowment. Thus, less intelligent mothers may well be in social positions which prevent the adequate access to the resources of the society, and they may also be less able to provide their children with the stimulation which can support full intellectual growth. Second, artificial restraints on social mobility due to discrimination will tend to maintain a heterogeneity of genetic, intellectual, and other endowments in the group which is discriminated against but does not sort itself out by social class. Third, a small amount of in- or out-migration may well minimize effects of assortive mating among the small breeding populations in rural villages. If, indeed, nutrition is related to intellectual endowment, those malnourished people who are least intellectually endowed will fail to realize their intellectual potential to the extent that they fail to survive.

Finally, and most important, is the fact that while some major portions of intellectual ability may be genetically determined, the expression of that ability in behavior depends to a considerable degree on the nature of the environment. The effects may stem from the distal environment through social class differentiations and the differential resources and services which the society provides for various social classes. Examples of these differences include access to equal educational opportunity, medical care, etc. The differences may also be in the proximal environment—differences in child rearing practices, home stimulation, and so on, which characterize individuals within the same social class.

Nonetheless, I did not raise the question of the relationship between genetic endowment and intelligence for the sake of having a straw man to destroy. The issue is real, intensified by the possibility that the genetic characteristics of those who survive in a nutritionally marginal state will show more significant differences in abilities and potentialities than those who survive under nutritionally more advantageous conditions. At the present time, we cannot say whether the possible intellectual differences between the well nourished and malnourished are genetically deter-

mined or whether poor nutrition simply acts to set limits on the phenotypic expression of intellectual and other potentials (or perhaps creates physiological changes which alter intelligence, role potential, and so on). The question is important because a radical shift in the nutritional status of a population will carry with it other behavioral changes resulting from changes in the survival rate of persons with various genetic endowments, and may thus create radical shifts in the nature of populations. The direction and consequences of these shifts and how they would interact with changing social orders are, of course, unknown. We ought to pay some attention to it.

Summary and Conclusion

I have suggested that distal and proximal social conditions which are associated with malnutrition tend to inhibit adequate intellectual development, independent of nutritional status. At the same time, the physiological changes—particularly the lack of responsiveness, lack of attention, and apathy which characterize the malnourished—may themselves interfere with adequate intellectual development through blocking external and internal stimuli. The relationship of genetic endowment to malnutrition and intellectual capacity is unknown, but there is some possibility that differential genetic endowment is a factor in the relationship. The responses of others to the malnourished individual who shows this lesser capacity may well lead to a negative self-image and a lowering of the level of aspiration which perpetuate inadequate performance.

Little is known about the relationship of nutrition to social competence. The extent to which malnourished individuals or groups are prevented from performing adequate roles in the society is unknown and unstudied. However, it is not unreasonable to posit that similar mechanisms will exist for social functioning as for intellectual functioning, that the lack of early learning due to lack of responsiveness will inhibit role development and adequate social functioning and will tend to perpetuate within the society a group which remains in a disadvantaged position.

Poverty is stigmatizing, and because hunger has become a polite synonym for the poor, it too is stigmatizing. In addition, for the child, hunger can be as de-energizing as severe malnutrition. If the child must spend his time worrying about having enough to eat, he will have neither the energy nor the attention available for learning. This condition, in turn, will create expectations about his abilities which will prompt differential treatment by his teachers and lowering of his educational rank in already insufficient school systems. Thus, he will be cut off from the

opportunities for educational attainment necessary for entry into an occupational structure where educational attainment is increasingly required (Kallen, 1971). Without the ability to enter into meaningful occupational positions, he has no choice but to remain at the bottom of the social status ladder, occupying economically and socially marginal positions. Under the present conditions in the United States (and probably in most of the highly industrialized societies which regard poverty as a negative individual characteristic rather than as a reflection of the nature of the social order), he is unlikely to have the resources to prevent his children from being hungry. Thus, the cycle perpetuates itself.

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A METHODOLOGICAL NOTE: THE DEVELOPMENT OF VISUAL ATTENTION IN INFANTS

by

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This is a brief report of the development of three stages of visual vigilance in infants. It is being presented at this point because debilitation of the infant, through malnutrition or any other means, may be reflected in the infant's progression through the three stages which I will describe.

The infant is seated in a Harvard Chair in front of a box which has two windows in it. In one of the windows a brightly colored ball with jewels on it is suspended on a nylon and elastic thread. The ball appears in one window for six seconds, is removed for a period of 3.5 seconds, and then is made to appear in the other window.

Visual looking by the infant is measured by observers behind the window. There is an observer behind each window; when the infant is looking at the window the observer depresses a recorder button, and simultaneously dictates commentary into a tape recorder. Movies can also be made from behind the window to permit later analysis of the visual fixations.

Until the baby is 30 to 40 days old, he will simply look at one window, without taking notice of the other window even when the balls are alternating in the window. Between 30 and 40 days, however, the babies move into the second stage and start looking at the other window when the ball appears in it. Very quickly after that they start to anticipate the appearance of the ball before it appears. That is, when the ball disappears from one window they move their eyes over and look at the other window as if they are waiting for the ball to appear in it.

Stage two continues until infants are about 50 days old, when stage three appears. Stage three is exemplified by the introduction of cross looking. In cross looking the infant will take fleeting glances at the other window when the ball appears in one window. They seem to be monitoring both windows at once. In ad-

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dition to this monitoring, when the balls are not in view they will scatter their viewing to look at various details in the room. They will often start by looking at a picture in the room, and then at other details in the room. They seem to be progressively expanding their visual world through the introduction of searching.

In this third stage they will also follow the ball while it is being retracted and continue the upward sweep of the eyes once the ball has disappeared from view. We regard this as the beginning of causality in the infant.

The baby moves through all of these stages longitudinally. If he is at a low level of vigilance, he may slip back to an earlier stage. Again, if the baby is debilitated in any way, including nutritionally, it may well reflect itself in the progression through these three stages.

Summary of Resulting Discussion

Many years ago the Yerkes laboratory showed a curvilinear relationship between food withholding and performance on a variety of problem solving tests of chimpanzees. That is, food withholding led to an incremental performance for a period up to 36 to 48 hours, and then there was a rapid decline in the degree of competence or problem solving by the animals. This suggests the possibility of a twofold effect when motivational or deprivation levels are increased. Shifts in performance in deprived or malnourished animals may or may not be similar. In order to understand these consequences it is necessary to specify all the variables since different sets of motives may be involved.

Barnes pointed out that in some kinds of tasks or performances, nutritionally stressed animals may perform at a better level according to the criteria than the unstressed animal. But this does not indicate that the malnourished animals have general advantages for adaptation. In many situations, the environment can be manipulated to provide for better comparative performance for a given animal. Retarded children can be trained to perform better than normal children in some situations; this does not give them an adaptive advantage in general.

The emphasis on the role of the social environment is important. Heath reported that when Harlow raised monkeys in isolation, but without nutritional deprivation, abnormal brain function was related to abnormal behavior. The question must be raised of the relevance of animal studies for human behavior. This is particularly true of the effects of malnutrition during fetal or postnatal development on subsequent generations of animals.

One rather poorly done study did report that when rats were

subjected to mild, but chronic, malnutrition there was no decrement in learning for the first generation, but there was a performance decrease in subsequent generations. In this, and in another study where the rat was subjected to severe malnutrition through the period of gestation and lactation, it took at least two generations on a normal diet to restore the performance of these rats. In the first generation, both learning performance and, in one study, growth, were deficient.

The lack of attention to generational effects does represent a serious deficit in much of the current animal work. A number of questions need to be raised: are we dealing with malnutrition over generations; what is the effect of the period (in development) that malnutrition is imposed; are the consequences of severe and milder levels of malnutrition different in kind or only in degree? The most knowledge would come from studies where malnutrition was imposed prior to conception, and continued through gestation and lactation. In addition, more attention needs to be paid to the effects of vitamin and mineral deficiencies, both independently of and in concert with protein-calorie deprivation. In such studies, where insufficient work is currently being conducted, the subhuman primate would often be the animal of choice. This is particularly true when the concern is with the behavioral consequences of the malnutrition.

The responses seen in animals or in humans after the early period of development are not just a direct function of nutritional deprivation. The animal is less responsive to the environment following nutritional stress than a nonstressed animal. In effect, it is the change in his early experience produced by nutritional deficit which makes him respond differentially later on. From this point of view, the same material environment may represent a deficient or an adequate environment, depending on the characteristics of the organism, or of his early experience. Thus, the hyperactive or hypersensitive responses to novel stimuli which characterize the malnourished animal may be functions of his experimental history which, in turn, was determined by his inability to respond appropriately to the normal environment early in life. There is some evidence that combining environmental isolation and malnutrition in the rat during the first three weeks of life, and then rehabilitating the animal, results in an increase in behavioral abnormality. This abnormality, which appears when the animal is tested some months later, is greater than that which would result from either condition alone.

The parallel in the consequences of nutritional deprivation and environmental isolation cited by Barnes is extremely important. Robert Zimmerman reared monkeys with their mother until they were about three months of age, and then weaned them to a

diet of known composition. At between four and five months of age the diet was changed from adequate to highly protein deficient. The animals were individually housed, and brought together for one hour a day to socialize. (If the socialization time is not provided the animal will go to pieces.) But, the malnourished animals withdrew from other monkeys in the cage. They remained isolated, paying attention only to themselves. The animals' curiosity for their peers practically disappeared under these conditions of malnutrition.

It takes the malnourished animal much longer to adapt to the experimental situation than the normal. This has important methodological implications. It may be that if the circumstances, motivational set, and so on, are maximized, better estimates of capacity can be obtained, but estimates of response cannot be obtained under these conditions. The learning sets are repeated over and over and over again. The animals learn the particular set well, but if a new object is introduced, they are completely thrown off. That is, the introduction of new tests shows seriously impaired learning. The acquisition curves of these animals are very different from the acquisition curves of the normal animal. Mason has also shown marked differences in the performance of isolated animals, particularly when it involves novel stimuli.

The conditions under which these animals are raised and tested do not really have much relationship to the situation of the child in the classroom. New experimental designs and test procedures are needed that will approximate, for animals, the life situations of children in the real world. The learning-set data traditionally used with animals does not do that.

There are some important distinctions between ability and learning, although it is a very ambiguous area. If the effective environment for the organism can be defined, it is then possible to introduce sequences of training that have habilitative and functional importance. It took a good deal of innovation and experimentation in animal work before this was done, and tests of performance for animals became matters to which they could respond, given their levels of organization and functioning. Thus, too, the definition of the functional consequences of any stress must depend on defining the way in which this stress has modified the responsiveness of the member of a given species to the world in which he lives.

There are, perhaps, two strategies. One is to evaluate the effects of stress on ability, the other to evaluate the effect of stress on learning. It may be that ability and learning are opposite poles in learning. The operational definition is the ease in changing response to a demand made with repeated presentations. Ability is studied through demanding a constant response across

a series of repetitions. Thus, differences in learning are not very useful for the prediction of competence or ability. At the same time, learning does involve a process that is also involved in the acquisition of abilities. Hence, in ability tests, the outcome of the individual's past learning history is involved. But this past learning history is a function partly of what the individual started with, partly of the stresses he endured, and partly of the response of the environment to his early interaction with it, and of the feedback he received from the environment.

The measurement of social stimulation related to specific factors is important. The measurement of generalized social stimulation is less important than measuring factors related to memory versus abstraction, for example.

The leads for this differentiation of stimuli come from the interest which now exists in looking at the effective components of the early environment of children. The focus is on the diversity and amount of stimulation that the infant is confronted with. More specifically, one needs to know the extent to which the infant has the opportunity to develop recognitive experience—that is, the extent to which he sees the same individual. Homes and institutions both differ in the opportunity provided to the child to differentiate a familiar from a nonfamiliar person. Is the continuity or stability of people in the environment sufficient to provide for this level of differentiation?

The same continuity needs to exist in the material environment, without the child being moved around from one place to another too much. In general, the child needs some continuity and some diversity.

The development of generalization and abstraction is a related matter. Although people are important, the infant needs the opportunity to explore, respond and attend to objects as well as to people. Providing the infant with objects he can handle and which differ in specific ways facilitates his identification of the essential characteristics of these objects. The ability to hold and to rotate objects is, particularly towards the end of the first year of life, one of the best ways for the infant to develop some concept of the permanence of the object and to be able to transform it in various ways and to recognize that it is still the same. It is not premature to begin to build such measures into field studies.

It was noted that there are problems in the use of the terms "social class" and "social stimulation." These problems arise primarily because the terms are often used either without adequate theoretical definition or without a set of operational definitions which permit dimensionality in their measurement. While outcomes will correlate with gross differences in social

class or in social stimulation, these correlational results do not permit the kind of causal inference which is necessary if the consequences of malnutrition are to be understood.

The problems may be likened to those of epidemiology. The tasks of epidemiology—or at least of good epidemiology—can be identified: 1) to define the prevalence of a phenomenon in a group at risk. This is important because it indicates whether a group has a given attribute to a greater or lesser degree than another group. 2) to define the locus of the phenomena in the group with the higher risk. This defining of the locus does not indicate causation, it simply indicates good places to look for causation. 3) to search for the particular attributes of individuals who succumb to the condition of risk as contrasted with those in the same locus who do not succumb. This provides a hypothesis concerning causal relations. 4) to test these causal hypotheses through clinical trials or intervention studies—an active effort to modify the circumstances and examine the consequences of this modification. If the hypothesis is correct, then the outcome should be changed.

At the same time, using social class as a locator variable, even if much dimensionality is lacking, can be useful. It depends, of course, on the question concerning nutrition which is asked. So far, nutrition has been regarded as an independent variable. From this point of view, a simple statement can be made: nutrition enables growth. No nutrition produces death. But then, the relevant question becomes, "Why malnutrition?" This is a legitimate question in this setting. The most promising answers to "why malnutrition" come from a conceptual frame of reference in which a social structural interpretation, involving stratification and restriction of life chances, are promising directions.

Within this framework, malnutrition may be only one of a series of noxious events which interfere with the development of the individual. Knowing a child is malnourished may also indicate a deficient mother-child relationship, insufficient early stimulation, poor educational opportunities, inadequate role models, and so on. All of these events, including the malnutrition, are the consequence of position in the society, but may also contribute to the infant's remaining in that position later in life.

While class position may be correlated with deprivation, and, to a greater or lesser extent, the deprivation correlated with certain psychological outcomes, the evidence is not as good as it could be. There is little that can be said with confidence about the clear-cut long-term effects of variations in maternal handling in ordinary homes. Studies of the grosser deviations in maternal care, which are discussed in Ricciuti's paper, do give some indications of less than adequate development of the infants.

On the other hand, there is some evidence that specific deficits in early experience do produce specific deficits in the children. There is some evidence, for example, that somatosensory deprivation produces disturbance in subhuman primates, and perhaps in human infants. Other studies, the long-range implications of which are not yet clear, are looking at mother-child interaction in terms of the effect it has on the cognitive development of the child. This is not the old class-correlation between weaning or early versus late toilet training and gross outcomes. These are studies which focus on the extent to which the mother points out crucial elements in the environment or relates the immediate to the far environment. What the mother does with the child seems to have some effect on language development and the ability to read. Other studies of habituation of infants to visual stimuli indicate some possibility of a relationship between the capacity to habituate in the first year of life and intellectual functioning as measured by other procedures. The analysis of vocalizations in the first year of life relates to later development.

At the same time, the deprivation literature does indicate that where there are some expressions of warmth, in terms of the emotional relationship with the child, the individual has better coping abilities. But these early relationships cannot be used to explain the totality of adult outcomes. A whole other set of forces, rooted, at least in part, in the social structure, come into force. These include the group relationships, the individual forms, the kinds of life style he develops in a social class context, a whole range of events which go beyond, and are not particularly influenced by, these early within-family events.

In all these studies the predictive value or the practical relevance of some of the newer measures is not yet clear. On the other hand, the utility of the traditional infant tests, such as the Gesell, is limited. The best thing to do is move ahead on both fronts, using the standard measures, and also using and developing measures in the newer areas. Partly, this provides some insurance within the studies, but, more importantly, it will enable conceptual development in this area.

The problem of genetics in the relationship between nutrition and outcome poses significant problems. One approach is as follows: studies indicate that women who do not receive antenatal care during pregnancy have a higher frequency of children who are mentally subnormal. One approach then regards the most parsimonious interpretation as saying that women who do not avail themselves of care are stupid, and stupid women have stupid children. The mental subnormality of the children is not related to whether or not the mothers received prenatal care, but only to the fact that women who did not obtain prenatal care

are stupid. But this is not an acceptable model, because it artificially and categorically separates genetics from environment, and nothing has ever been learned about genetics except in environment. A new mathematical model is needed, in which the interaction term is the center of the analysis. This newer model would take full account of the fact that there is never a separation between genetics and environment. Until this is worked out, it will be impossible to determine the relationship between genetics, environment, and outcome.

Nutritional effects may well be one of the particular features of the environmental mix which does contribute to variance. Genetic endowment may be one of the attributes of a location in which malnutrition is also found. There is clearly some disagreement as to whether or not this is a fruitful path to follow, and it will require the development of sophisticated models of population genetics to indicate whether or not there will be success in this direction of investigation.

II



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SOME METHODOLOGICAL PROBLEMS IN FIELD STUDIES OF NUTRITION AND INTELLIGENCE

by

Robert E. Klein,[†] Jean-Pierre Habicht and
Charles Yarbrough*

In a world containing perhaps a billion people who are or have been malnourished (Behar, 1968), the possibility of a relationship between malnutrition and some form of impaired psychological performance has provoked a great deal of attention. The need for large scale collection of longitudinal data in order to assess the effects of malnutrition has led to a number of major field studies. All such studies of malnutrition and mental development are bedeviled because there are no generally recognized operational definitions of the two terms involved. We, at INCAP, have formed an interdisciplinary group to attack this problem. Our group consists of a child psychologist, an anthropologist, a statistician, a pediatrician, an epidemiologist, an immunologist and a biochemist. We are collecting data in four rural *ladino* Guatemalan communities, studying a total of 600 children under the age of seven, and their mothers. Moreover, during our projected seven years of longitudinal data collection, births will add another 100 children a year to our sample.

A major concern in such a project is data collection procedures. Not surprisingly, after one year we found that our ideas as to the kind of data to collect and how to do so have undergone considerable elaboration and extension. In this paper we shall discuss the current range of variables we feel important, how they might be defined, and into what general scientific context they fall. Since the data and results of our first year are being presented elsewhere, the findings we present here are offered only as examples for discussion.

In many ways, a prospective field study of the effects of malnutrition on mental development seems deceptively easy. After all, what is required is only a measure of nutrition

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which displays variation in a naturally occurring population, a measure of intelligence with the same characteristics, a clearly demonstrated statistical association (or its clearly demonstrated absence), and the absence of any obviously confounding relationship. A rigorously scientific solution based on a carefully elaborated model of the physiology of nutrition and learning would be esthetically pleasing, but as a first step, a simple statistical association would do. Unfortunately, we found that available nutritional measures of adequate precision were not practicable. While casting around for satisfactory measures we found ourselves reexamining many of the assumptions involved in developing accepted measures of nutrition. The need for rigorous definitions of objectives and testing of hypotheses was apparent. Similarly, it seems that no demonstration of an effect on psychological performance will serve without an intellectual underpinning of considerable detail.

Nutritional Status

Nutrition must be quantified if its effect is to be measured and there are many widely accepted measures for this purpose (Jelliffe, 1966; Arroyave, 1968). These can be arbitrarily classified as those which measure nutrient intake and those which measure the results of nutrient intake.

First, we will discuss measures of nutrient intake. Estimates based upon the total food consumption in an entire area are of considerable epidemiologic value, and have been shown to have high correlation with physical growth characteristics of the population as a whole in the same area. In our study, however, the differences in average consumption between villages is quite modest, even after an effort to supplement the diet in two of the villages. In view of a large natural variability in the intake among children, measurement of mean village nutrient intake does not discriminate with sufficient precision for statistical analysis. Moreover, such a technique may lead to fallacies of ecological correlation (Robinson, 1950).

Although estimates based upon total food consumption of populations are of little use in this context, dietary surveys of individuals seem to have the advantage of discriminating among various types of malnutrition and of defining the relative degree of malnutrition among children. This could be extremely useful, as malnutrition is not a single entity due to just one nutrient deficiency. For example, calorie deficiency producing marasmus may be found in some children of a village, while others will be suffering primarily from protein deficiency, kwashiorkor. Indeed, a marasmic child's diet may shift slightly and he will

develop kwashiorkor. Clear labeling is simply not possible, so the agent is called protein-calorie malnutrition. We believe, however, that just as the biochemical, physiological and clinical expression of marasmus and kwashiorkor are fundamentally different, so will their effects on mental development also be fundamentally different. They must be separated.

Unfortunately, dietary surveys of individuals have proved, so far, unequal to the task in the context of our field study. The variation among children in the same age group, in calories, is 120Kcal. (standard deviation). In vitamin A it is 213% (coefficient of variation). Thus, the normal variability of dietary intake is large within an age group. One would expect that the variability of the dietary survey method would be smaller than this population variability. Therefore, we examined the daily registry method, which combines weighing of foods with estimates of amount consumed (Flores, Menchu, Lora and Guzman, 1970), the most precise dietary survey method practicable. Here we found that the variation from survey to survey for calories was 255Kcal. (standard deviation) and for vitamin A 212% (coefficient of variation). We present these two nutrients because they represent the extremes in variability among the nutrients measured. Thus, it is clear that an instrument of such gross relative imprecision is inadequate to define the dietary intake of these nutrients, except as an estimate of mean nutrient intake per village. However, we must differentiate between the better and worse nourished groups within each village. The precision of estimates for individuals could be improved by increasing the survey frequency, but expense renders this impractical. Thus, what appeared to us the obvious solution to the problem of estimating nutritional status did not satisfy the rudimentary criteria of statistical association from one survey to the next.

Therefore, we reassessed the prerequisites of an adequate dietary survey method. We decided the method need only be precise enough to permit the reliable ranking of children and to separate the better and worse nourished groups. The reliability is measured first by how reproducible the ranking is from survey to survey. Then independent biochemical and growth estimates of nutritional status must be shown to be correctly associated with the ranking, to show that the dietary survey method is reflecting a physiologically meaningful variation in nutrition.

A three-day recall method is less precise but also less variable than the daily registry method. Validation of this three-day recall method indicates that the error of recall for calories and proteins is significantly less than the daily variation of the diet (table 1) and that this error tends to reduce the variability from survey to survey. This recall method does provide reliable rank-

TABLE 1
Comparison between the daily registry and three-day recall methods

	Standard deviations	
	Calories	Proteins (gms)
1. From survey to survey		
a. Daily registry method	255	4.25
b. Three-day recall method	132	3.53
2. Daily registry method compared to three-day recall method of the same children of the same day	154	1.62

TABLE 2
Dietary surveys
Correlations among two estimates of nutrient intake of same children performed three months apart

Nutrient	Daily registry method	Three-day recall method	Significance of difference between correlation coefficients
	N = 138	N = 46	P
	Correlation coefficients		
Calories	.263	.570	< 0.05
Protein	.419	.476	not significant

ing (table 2) in both calories and proteins. The validation of this ranking of the children for protein and calorie intake will have to be undertaken by biochemical surveys and by judging total nutritional adequacy from growth rates. However, none of the dietary methods provides a ranking of children within a village for vitamin A, iron, niacin, or riboflavin intake.

We considered omitting the dietary surveys and relying upon randomization of nutrition among our villages. In this fashion, by supplementing one group of villages and not the other, we would be assuring adequate nutrition in some children while the others suffered their usual inadequate diets. Unfortunately, children have different attendance habits at supplementation centers. Thus, this plan presents more problems than it solves in estimating nutritional adequacy because some children always attend, others never, with the majority somewhere in between. Also, dietary adequacy is probably related to family characteristics which may affect mental development independent of diet. It is, therefore, vitally important to be sure that there is an adequate representation of children partaking of the supplement from each level of home dietary adequacy to permit comparison with a similar ranking of children whose home diets are not supplemented. Therefore, dietary surveys must be included unless

we can exercise actual or statistical controls for all familial characteristics which may influence mental development.

When accurate information on home diet is obtained through dietary surveys, the provision of a dietary supplement does permit the differentiation of the effects of nutrition from the effects of social and familial factors which may independently affect either the home diet or mental development or both. This differentiation of social and familial factors from nutritional influences on behavior can be made, however, only if the supplementation insures good nutrition through making up for inadequacies in the home diet.

Dietary surveys indicated that the mean village intakes of calories, proteins, niacin, riboflavin, vitamin A, and iron were inadequate for all age groups in this study (table 3). A supplement combining a high protein-vegetable mixture with powdered skim milk was formulated (table 4). The effects were tested first on rats with favorable results (Erdmenger, Gonzaga, Souza, Salomon, Bressani, Arroyave and Habicht, 1970), and then provided to preschool children.

Theoretically, the addition of the supplement to the home diet provides all children with adequate protein intake (table 5). However, our dietary surveys indicated that even this supplemented diet remained inadequate in calories, riboflavin, niacin, vitamin A, and iron for a majority of the children (table 5) as measured against current recommended allowances (NAS/NRC, 1968). To determine whether this was, in fact, a physiological inadequacy for these nutrients, a biochemical survey (Habicht, Schwedes, and Arroyave, 1970) was conducted. We compared two-year-olds matched for frequent attendance at supplementation centers (N=19) with those attending a center where a supplementation surrogate is distributed (N=15). This surrogate contains only 70 Kcal. of sugar per cup. We found no anemia and

TABLE 3

Percentage of children whose home nutrient intake is equal to or above the recommended allowances* Conacaste Village, Guatemala (1969)

Age in months	0-11	12-23	24-35	36-47	48-59	60-83
Proteins	15	40	48	33	67	63
Calories	0	14	36	14	17	0
Riboflavin	29	7	4	0	6	0
Niacin	29	29	12	6	6	0
Vitamin A	15	40	40	60	61	25
Iron	0	0	0	7	6	12

*Recommended allowances:

Calories: by height NAS/NRC (1968)

Others: by age

TABLE 4
Formulation and composition of food supplement

Formula of supplement per 100 ml	
Ground whole cooked corn	4.35 gms
Cotton seed flour	2.85 gms
Torula yeast	0.22 gms
Calcium carbonate	0.08 gms
Dry skim milk	12.00 gms
Sugar	5.00 gms
Vitamin A	338 IU
Composition of supplement per cup (180 ml)	
Protein	10.8 gms
Fat	0.9 gms
Carbohydrate	27.3 gms
Thiamin	0.36 mg
Riboflavin	0.54 mg
Niacin	1.2 mg
Vitamin A	610 IU
Calcium	393 mg
Iron	1.3 mg
Phosphorous	313 mg
Potassium	2.88 mg
Sodium	2.52 mg
Total calories: 162	

TABLE 5
Percentage of children
with adequate nutrient intake* if all children attend Supplementation Center
Conacaste Village, Guatemala

Age in months	0-11	12-23	24-35	36-47	48-59	60-83
Proteins	100	100	100	100	100	100
Calories	15	47	76	73	67	50
Riboflavin	57	27	8	0	6	13
Niacin	57	40	16	7	17	0
Vitamin A	70	46	64	73	72	38
Iron	0	0	0	56	18	25

*Defined as in table 3.

no vitamin A or niacin deficiencies. Thus, in spite of the fact that the estimated intakes of these children were below the recommended allowances, there was no biochemical evidence of deficiency of these nutrients even in the unsupplemented children. Only indices of riboflavin and protein nutrition reflected inadequate intake. The protein indices revealed adequate protein intake for all the supplemented children. The urea/creatinine ratios were all above 11.5, and the serum albumins were all above 4.1 gms/100 ml. Over half the unsupplemented children had urea/creatinine ratios below 11.5. Further evidence of the efficiency of the supplement was revealed by the improved growth rates of the supplemented children as compared to the retarded growth of their unsupplemented counterparts.

Because of this biochemical evidence and because of the appearance of occasional protein, calorie and riboflavin deficiency syndromes, we believe protein, calories and riboflavin to be the only limiting nutrients in these villages. However, when these village diets are complemented by a protein and calorie supplement, not only riboflavin but also other nutrients such as niacin, iron and vitamin A should also be included in the supplement to be sure that they do not become limiting.

This concern about supplementation causing dietary imbalance applies to the children receiving the "empty" calories of the supplement surrogate as well as to those receiving the supplement itself. Thus, we are planning to include vitamins and iron in both. This seems especially important as there is no practical way to estimate the home intakes of these nutrients.

Under these circumstances, one's attention may be restricted to protein and calorie nutrition, and children may be ranked and matched between supplemented and unsupplemented villages, with the assurance that no uncontrolled and unmeasurable deficiencies are confusing interpretation.

The above estimates of nutritional intake provide only one part of the information necessary to estimate nutritional status. The nutritional requirements of the individuals must also be known. This is difficult to ascertain, even in metabolic wards, and is impossible in a field study of so many children. Lean body mass is one of the principal factors affecting protein and calorie requirements. The adequacy of nutrition can be estimated as indicated above by growth rate (Jelliffe, 1966).

Anthropometry measures variables which can be used to estimate nutritional requirements (height and weight) and variables which reflect the adequacy of nutrition through growth. The variables in table 6 seemed to us adequate to measure linear growth, bone development, fat deposition, and the growth of

muscle mass. The first two reflect general nutritional adequacy. Fat deposits indicate caloric adequacy of the diet and muscle mass reflects protein adequacy. This presumptive model has proven satisfactory in all areas save estimating muscle mass (table 6). From table 6 and the statistics of the different variables within age groups one may evolve equations, whose sum will be an index of general size (equation A, table 6) or of fat (equation B, table 6). The mean of these indices is zero with a standard deviation of one. When a child's measurements are fitted into the equation, the equation will result in an index of how large or how fat he is in relation to his age group. The relative importance of the variables is indicated by their order in the equation. It would be neater if the weighting given the variables indicated the order of importance, as for the index "fat," and if only those variables which contribute significantly were included. The index "fat" approaches a satisfactory first approximation because it has a subjective internal logic, in that it is negatively related to length, positively related to variables thought to be associated with fat deposits and not related to head circumference.

TABLE 6
Orthogonal quartimax factor loadings of
anthropometric data within age groups

Ages 0 to 84 months, N = 1376				
Variable	Factors			Communality
	1	2	3	
Total weight	.872	.195	-.204	.839
Total height	.928	-.157	.031	.887
Sitting height	.915	-.076	.027	.843
Head circumference	.842	.000	.369	.844
Thorax circumference	.868	.176	.097	.793
Upper arm circumference	.698	.576	-.136	.836
Diameter of the wrist (Bistyloid diameter)	.718	.180	-.569	.872
Arm tricipital skinfold	.257	.882	.135	.862
Subscapular skinfold	.065	.910	-.123	.847
Sum of squares	4.991	2.068	.564	7.624

Indices:

A. "Size" = .0087 (height in cm) + .0142 (sitting height in cm) + .0278 (weight in Kg) + .0128 (thorax circumference in cm) + .0147 (head circumference in cm) + .0132 (wrist diameter in mm) + .0254 (arm circumference in cm) + .0063 (triceps skinfold in mm) + .0021 (subscapular skinfold in mm) - 2.21 (age in months) - 29.78

B. "Fat" = .0446 (subscapular skinfold in mm) + .0343 (tricipital skinfold in mm) + .0326 (arm circumference in cm) + .0097 (body weight in Kg) + .0041 (thorax circumference in cm) + .0033 (wrist diameter in mm) - .0023 (total height in cm) - .0018 (sitting height in cm) - .0000 (head circumference in cm) - .0365 (months) - 10.97

We are thus refining our anthropometric method, including other measures of muscle mass, so as to develop an appropriate index of protein nutrition. In future analyses we will include X-ray data which consists of bone age by the Greulich-Pyle and Tanner-Whitehouse methods, cortical thickness, and incidence of bone anomalies of the head and wrist. Once we have defined the vectors of muscle mass and fat, these must be validated by biochemical and physiological methods, probably in metabolic wards.

Another major factor affecting nutrient requirements is disease (Scrimshaw, Taylor and Gordon, 1968; Pollack and Sheldon, 1970). Disease not only influences nutrient intake, but also social stimuli and their psychological integration. Estimates of illness are thus important as one attempts to reduce this disturbing variable to a minimum. The rationale and components of our preventive and curative services are described elsewhere (Habicht, Reyna-Barrios, Guzman, and Gordon, 1970). Here it is sufficient to note that the estimates of disease must concentrate on those aspects of illness which may effect either nutritional status or mental development. These can be summarized as severity and duration. Incidence is secondary in this context, although the problem of incidence may affect the index of severity. This is the reverse of the usual priority of morbidity surveys in which definition of the disease agent is the object. Changes in nutrient intake and deprivation of social and psychological stimuli are also estimated. Each child's health, from birth through seven years of age, as well as his mother's during pregnancy and lactation, is recorded through a bimonthly interview with the mother or guardian. We are at present checking the validity of the interview method. We will then validate the assumptions made about the effects of illness upon nutritional status and mental development.

Another measure of the physiological adequacy of nutrition is provided by biochemistry (Arroyave, 1968; Whitehead, 1969). Longitudinal biochemical surveys in small children do not seem practicable because much information requires drawing blood. The logistics are difficult, the analysis expensive, and above all, the results can probably be achieved otherwise and less expensively. However, biochemical surveys have an important role to play in our experimental design. They are used to validate other methods. Examples have already been given regarding estimates of dietary intake and the adequacy of the supplement and validating the use of anthropometric indices of nutrition.

So far, the methodology we have presented serves, at best, to describe the child after birth, or in the case of nutrient intake, after weaning. But the child has been growing long before then,

and it is essential to have some estimates of his previous health and nutritional status. To this end we have initiated studies of intrauterine and suckling development. We are trying to assess the health and nutrition of the mother, both for its own sake and to establish indices of intrauterine infection and placental function and determine the quantity and quality of breast milk.

Psychological Performance

Psychological performance as the outcome variable generates two major areas of concern: the adequacy of our operationalization of our concepts (i.e., the degree to which our tests are an accurate, thorough and valid measure of the concepts we think we are measuring) and the confounding of our interpretations of measured psychological differences between well and malnourished children by other variables. Most of our comments deal with the second of these concerns; problems encountered in the interpretation of demonstrated differences in psychological performance between well and malnourished children.

Psychological performance has been studied under many guises. It appears variously as intelligence, as psychomotor development, as maturational or developmental indices, and as measures of personality. There is a great diversity among these concepts and it is an open question as to what should be the focus of the research in this area. Significant findings using some operationalization of any of these concepts as a dependent variable would be interesting, provided, of course, that the tests employed meet accepted criteria for reliability, validity, and cultural appropriateness.

The range of psychological tests which have been employed in nutrition studies is as large as the range of concepts behind them. In some studies, mental development has been operationalized in terms of performance on specific psychological tests (Cravioto, De Licardie and Birch, 1966; Brockman and Ricciuti, 1966), whereas in others, attempts have been made to measure rather comprehensively such concepts as cognitive processes, or intellectual development (Segall, 1970; Klein, Yarbrough, and Habicht, 1970; Cobos and Guevara, 1970). But regardless of how the investigator chooses to conceptualize his dependent variable, one of the most critical aspects of the study of the effects of malnutrition is the selection of the situation and the behavior which reflect the theoretical construct chosen for measurement. Examples of this procedure, are the use of a cross-modal matching task as an index of intersensory development or a memory for digits test as an index of short-term memory.

The complicated problems of test validity and reliability

will be dealt with elsewhere. Therefore, we turn our attention to a second area of concern: that of confounding and the attendant problems of interpretation of experimental findings.

Confounding, our second concern, raises difficult problems of interpretation, and questions as to the structure of personality and mental abilities cannot be avoided. It is a doubly complicated issue because findings are confounded both by such external variables as child-rearing practices and also by the complex psychological inter-relationships within a single child. Thus, any one of several underlying variables may produce similar test results, and this leads to great difficulties in constructing adequate tests of hypotheses.

An example of a case wherein simple statements about observed response differences between well and malnourished children may be misleading comes from our own research (Klein, Gilbert, Canosa and De Leon, 1969). We compared a group of previously malnourished children, who were nutritionally recuperated at the time of testing, with a group of children who had no history of malnutrition, on several tests of short-term memory. Since we had good psychometric evidence that these memory tests were a satisfactory index of the construct of short-term memory, we were inclined to hypothesize that malnourished children had short-term memory defects. Happily, we attempted a replication and extension of our findings in a second study, and we structured this extension in such a way as to allow rejection of our previous findings. In the replication study we found that the previously malnourished group again performed more poorly on several, but not all, of our short-term memory tasks. Furthermore, the general pattern of test differences between the well and malnourished subjects in the second study precluded a simple interpretation of memory deficit. Rather, the differences between the two groups seemed to be related to attentional or motivational factors rather than simple problems of short-term memory. These hypothesized attentional and motivational differences between well and malnourished children are currently being explored by our group as possible mechanisms which mediate the observed performance differences between well and malnourished children.

Problems of interpretation of results also accrue to the confounding of variables external to the child. Take, for example, social structural position. It is by now well recognized that many pioneering studies in malnutrition are hopelessly compromised by failure to adequately control for social class. In our study, we operationalized the concept of social structural position in rather a traditional way by constructing indices which reflected income, education, and family structure. We regressed these in-

dices against psychological performance for a group of children in our sample and found that we could account for a sizeable portion of the variance in psychological test performance: 20% of the variance for a test of vocabulary development, 30% of the variance of a test of perception, and up to 30% of the variance for measures of response speed on tests wherein measured thoughtful responding is conducive to better performance.

The finding that response speed as well as other aspects of test performance vary powerfully with social structural position illustrates two important and related considerations in nutritional research. The first is that there is a wide range of possible mechanisms which mediate performance differences between well and malnourished children. An example of this point comes from a study conducted in Guatemala (Witkop, Baldizon, Castro and Umaña, 1970) wherein children who had been hospitalized and recuperated from kwashiorkor were found to perform significantly more poorly on a test of intersensory integration than a group of controls. Response speed was also found to be significantly related to the number of errors for both the well and malnourished children. When we consider that response impulsivity has been demonstrated to be an important factor in predicting performance on difficult tasks (Kagan, 1966), a clear interpretation of the differences between well nourished and malnourished children requires that these differences be demonstrated independently of individual differences in response speed. Pursuit of this issue may reveal that malnourished children are more impulsive and that their poor performance is due to this dimension of response style and not to a reduced ability to integrate stimuli from two modalities.

The general problem of controls in nutritional studies is the second important consideration highlighted by our findings that test performance varies significantly with social structural position in rural village preschool children. It is widely believed that child-rearing practices central to the development of intellectual performance vary dramatically across social classes and that this accounts for much of the perceived differences in psychological performance (*Perspectives in Human Deprivation*, 1968). Since the nutrition of a child also seems to vary with social structural position, social structural position must be estimated separately. In most investigations, such estimates usually take the form of blocking variables, wherein the investigator groups subjects from families which are generally similar, usually in terms of income and parental education. The disadvantage of this technique is that the investigator is in no position to account for variability within his social structural groups. An obvious alternate strategy is to attempt direct mea-

surements of different child-rearing styles and behaviors and then to relate the family child rearing characteristics to the effects of malnutrition. Such an experimental design will allow the investigator to analyze the possible interactive effects between malnutrition and psychological performance based on the possibility that certain child rearing techniques may function to ameliorate the impact of malnutrition on psychological development.

Conclusion

We began with the public health question about a relationship between nutrition and intelligence. An answer to this, even if uninformed by an understanding of the underlying mechanisms, is greatly desired. In pursuing this question we have been drawn inexorably into precisely those scientific operations required for the elucidation of a model. Because of the complexity of the variables with which we deal, careful definitions are essential; otherwise, unambiguous interpretations are impossible. Similarly, the wealth of conflicting and plausible mechanisms make careful experimental designs unavoidable. It is possible, of course, to list an unending series of "what if" variables and mechanisms but even when we restrict our attention to variables with known associations with nutrition and intelligence, we are left with the situation so complicated that only the elaboration and verification of a model seems to hold the hope for sorting out cause and effect.

Finally, we wish to return to the public health question and emphasize that, even in the presence of scientific findings, there are broader problems of interpretation. Beyond the problem of estimating the magnitude of an effect lies the question of the significance of that effect. For example, in a large cross-sectional study, we found that for many psychological tests in our battery, children who were tall for their age performed consistently better than children who were short for their age. Although no single test was significant, the consistency of the direction of the differences suggested a mild effect. An analysis of the power of our design, however, showed that, with a probability of greater than .99, the differences were on the order of not more than one word in 16. While such a finding may suggest future inquiries, its practical relevance seems small. Not all differences will be so inconsequential, but this will only be clarified when the magnitude of effects and their functional significance are carefully considered.

NOTE: The research for this paper was supported by Contract #PH43-65-640 from the National Institute of Child Health and Human Development, National Institutes of Health.

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NUTRITION AND BEHAVIOR IN HEAD START CHILDREN: RESULTS FROM THE TULANE STUDY

by

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Most early research on malnutrition has been done in developing countries, either with patients under treatment, or with subjects presumed to have suffered extreme protein-calorie deficiency at some critical period in life. The results indicated that severe malnutrition could not only retard physical growth but might also hinder psychological development. Although the controls in these investigations are often weaker than laboratory scientists might like, there seems to be little doubt that protein-calorie malnutrition is one of the variables capable of producing intellectual decrement in a generally disadvantaged population. More recent studies are investigating the effects of milder continuing malnutrition on intellectual functioning.

For several years in the United States the Office of Economic Opportunity has sponsored a joint effort of the Tulane Early Childhood Research Center and the School of Public Health and Tropical Medicine to study behavioral differences between children with mild iron-deficiency anemia and children in normal health. The children studied were drawn from the Negro population of New Orleans, a group which is generally more deprived than the total population, and had already been found to have a higher-than-usual incidence of iron-deficiency anemia. In the beginning we selected a large number of four- and five-year-old preschool children from five Operation Head Start centers, realizing that there were unique advantages and disadvantages in using this group. On the positive side, we had a large number of subjects who were close in age and similar socio-economically. Working in the head start centers insured identical environments for testing both malnourished and normal children. Because of their youth we were able to test subjects before extra variance was intro-

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duced by formal schooling and individual reactions to it. This was an important consideration, since many ability tests tend to measure achievement to some extent, and individual differences in motivation probably are amplified by the school experience.

The use of this group did present some real problems, however. The head start program lasted only six weeks and each child was available for testing for approximately only ninety minutes. The work had to be done in crowded and often noisy schools, so we had to find intrinsically interesting instruments or tasks which would reliably assess behavior in Negro children at this young age. Another difficulty stemmed from the separation of nutritional and behavioral data-gathering and administrative operations, which insured blind testing conditions for the psychologists but often interfered with coordinated planning and analysis of overall results.

There is little literature concerning the effects of iron deficiency upon behavior, either with humans or lower animals, possibly because the few published results indicate that iron deficiency is not a potent determinant of psychological function. For example, Bernhardt (1936) found no difference between iron-deficient rats and controls in maze-learning ability measured by error scores, but reported a correlation of .57 between severity of deficiency and the number of trials required to reach a performance criterion. With respect to prenatal influence, Scarpelli (1959) reported that rats born of iron-deficient dams but nursed on normal dams showed no inferiority in maze-learning at 42 days. One of the few published studies dealing with the behavioral effects of anemia in humans was reported by Werkman, Shifman, and Skelly (1964). They studied 28 iron-deficient children, including 22 Negroes, all from disadvantaged homes, and reported that they were more illness-prone, experienced more feeding difficulties, and manifested more behavior problems than normal subjects. More recently, an unpublished report by Nancy Munro (1966) described an investigation of the relationship between iron-deficiency anemia and behavior involving head start children in Montana. She did not find particularly striking behavioral decrement associated with hematological measures. The only significant finding she reported was a positive correlation between the change in IQ and the change in the iron level among a group with the lowest hemoglobin. In commenting upon the weak findings, Munro concluded that her lowest hemoglobin values (10.0—12.0 gm/100 ml) might have been produced by some deficiency other than, or in addition to, iron deficiency; in fact, this level of deficiency is only borderline by some standards.

The paucity of existing data indicated the need of further investigation in this area but provided little basis for specifying

the kinds of psychological decrement which might be linked to iron-deficiency anemia. To maximize the chances of finding any relationship, the present investigation adopted a variety of psychological measures representing different kinds of behavior. By examining the relationships among dependent variables as well as between independent and dependent variables, we hoped to provide potentially useful information regarding the nature of the underlying processes.

Procedure

Over three-hundred male and female four- to five-year-old Negro children enrolled in the Head Start program in the summer of 1968 were given all or some of the tests and tasks described below. The children were tested at five Head Start centers selected as representative of the different urban geographic areas served by the program. The percentage of children upon whom all measures were obtained varied from center to center because of differences in locations of the testing rooms and problems of traffic control. However, there is no indication that this produced bias pertinent to the subject of the investigation.

The testing environment was far from ideal for individual assessment; it did not provide a lengthy period for establishing rapport with the child before he played his first "game," and the physical setting was noisy, although no more so than the typical classroom in these schools. Testing was terminated if a child was uncooperative, highly distracted, or excessively bored or shy, and this fact was noted in his record. To the extent that these characteristics are associated with iron-deficiency anemia, results might be biased in a conservative direction.

TESTING INSTRUMENTS AND TASKS

To insure that the instruments were methodologically suitable for testing the children, some pilot work was undertaken with kindergarten and grade school children drawn from an education improvement project in a predominantly Negro school. On the basis of results of this pilot study some measures were discarded and some procedures were modified. The measures finally selected were divided into two batteries for ease of administration and training test administrators. Battery I consisted of two intelligence tests and two measures of cognitive development. Battery II included a short-term memory task, a group of reaction time tasks, a work-endurance measure, and a brief food preference test. From about one-fourth of the subjects speech samples were also obtained.

Battery I

Kahn Intelligence Test

The Kahn Intelligence Test (KIT), (Kahn, 1960a, 1960b) was selected because it was described as an experimental measure of intelligence which is relatively independent of cultural, educational and verbal requirements. The KIT manual reports a reliability coefficient of .94 and moderately positive correlation (.74) with the 1937 Stanford Binet. However, no norms are established for the population represented in the present study. The scale used has six items of graded difficulty at all age levels from infancy to fourteen years of age. It provided measures of mental age and IQ reflecting two months mental age credit for each correct item.

Van Alstyne Picture Vocabulary Test

The Van Alstyne Picture Vocabulary Test (VA), (Van Alstyne, 1961), emphasizes verbal achievement. The test is composed of sets of cards each bearing four realistic line drawings of objects or figures. The subject's attention is drawn to the pictures and he is asked to point to a specific item, i.e., the box, the barrel, the girl who is drinking, etc. Items are presented in an increasing level of difficulty. A definite response was required for each item without exerting pressure upon the child, and if the child said he did not know or refused to respond, a question mark was recorded for that item. If a child appeared to be responding erratically (i.e., randomly pointing at the cards), or seemed too restless, these observations were recorded and testing was terminated. Only complete records were scored. Scoring was based upon the total number of correct identifications made by the child and yielded mental age and IQ equivalent measures based upon established norms.

Measures of Cognitive Development

Two measures of cognitive development were adopted for this project, representing different kinds of psychological function. One of these was designed to provide information regarding the child's level of moral development and was refined from a procedure used by Piaget (1932) in which the child indicates which of two stories describes the worse behavior. His level of judgmental sophistication is determined by the extent to which he judges on the basis of the actor's motive rather than the magnitude of the outcome. Six pairs of short stories, accompanied by displayed drawings to illustrate the action, were read in an order which made discrimination increasingly difficult. One point was scored each time the judgment was theoretically more mature.

The other measure of cognitive functioning involved simple grouping behavior and was based upon a task described by Goldstein and Scheerer (1941). In this task the subject was asked to group ("put together the things that belong together") from three to nine plastic objects, varying in form and color. The assumption underlying the test is that less sophisticated subjects will group the objects on the basis of color rather than form when either possibility is present, and that even less conceptual sophistication is evidenced by subjects who simply arrange the objects on some other basis. Studies by Suchman and Trabasso (1966) and others have demonstrated that a transition from color to form preference is a correlative of cognitive growth. This test was included because it seemed to be a measure of conceptual function requiring no verbal response from the subject and only minimal attentiveness and verbal comprehension.

Battery II

The tasks in the second battery were designed to provide measures of endurance, reactivity, attentiveness, and simple learning requiring minimal verbal comprehension and transfer from previous experience. To evaluate these factors, the apparatus and tasks were designed to present the child with an attractive and challenging game situation which was non-threatening. While administering the tasks the male examiners maintained an attitude of enthusiasm and made liberal use of social reinforcement and encouragement.

Reaction Time Tasks

Three different reaction time tasks were performed on the same apparatus. Its vertical console presented the subject with four panels in a horizontal line and four panels in a square beneath them. Each panel could be lighted independently, and reaction time was measured electrically from the onset of a light to its offset when the proper panel was pushed. The first task measured *simple reaction time*; one lower panel was lighted and the child pushed it as fast as he could to turn off the light. In the second task, *disjunctive reaction time*, either of two panels might be lighted and the child again pushed it off as rapidly as possible. The third task involved *associative learning*; the subject learned to associate each of the four response panels with a stimulus panel in the row above. The stimulus panel illuminated a drawing of a familiar object, and time was measured until the child pressed the correct response panel, which lighted up to provide feedback. After training the child to learn each of the four associations (to a criterion of five correct responses), the examiner quickly reviewed the relationships and gave ten test

trials, scrambling the order. The number of errors and latency of the correct response was recorded during both training and test trials.

Attentive Recall Task

Some tests of intelligence include one or more items dealing with short-term memory, usually in a form in which the subject repeats a series of digits forward or backward. We wanted to include a test of short-term memory in our battery, but because the digit span test was inappropriate for preschool children, the attentive recall task was adopted. This comprised ten pretested cards bearing pictures of familiar objects, a purse, a cat, a tree, a house, a bird, scissors, a spoon, a dog, a flower, and a bicycle. On the first trial the subject was shown two cards and asked to name them. The examiner then picked them up, removed one, showed the child the remaining card, and asked him to name the one that was missing. If a correct identification was made on any of three trials, the set was increased for the next round by adding one new card. This continued until three trials with a given set failed to produce a correct response. The subject was scored on the maximum number of cards he worked with and the latency of the correct response.

Cranking Task

The cranking task was designed to provide a measure of endurance and achievement motivation. The apparatus was built from a surplus "Gibson Girl" radio transmitter designed for downed pilots to signal for assistance. Turning the crank of this transmitter produced an electric voltage. When modified, this output tripped a relay which activated a timer recording total time of cranking at, or exceeding, the required rate of about one revolution in 1.5 seconds. To provide an incentive for our subjects, the apparatus was mounted in the center of a colorful plywood clown whose eyes and nose lighted up when the requisite cranking rate was reached. The entire apparatus was secured to a heavy wooden bench. The task was demonstrated by the male examiner who then challenged the subject to keep the clown lit up as long as possible, cranking with only one hand. In addition to the record provided by the automatic timer, the total time cranked and the number of revolutions were also recorded.

Results

To distribute the potential effects of the Head Start program in an unbiased manner, the data should have been gathered simultaneously at each of the five centers or in small lots in block

randomized order. However, practical problems in scheduling made it necessary to test at the centers sequentially. Before combining the data for full analysis, comparisons were made to determine whether differences in testing environment or scheduling were reflected in measures obtained from different locations. Parametric analyses revealed no significant differences among the five centers in any of the behavioral measures or indices of nutritional status. While the children at one center scored slightly better on many of the measures this appeared to be unrelated to scheduling or testing effects.

Sex Comparisons

Before looking at the analyses based upon the entire sample, the data were examined for possible sex differences. The performance of males and females was compared to see whether, as Bernard Brown (1970) has suggested, the effects of the disadvantaged environment were greater on male children, and whether there were differential reactions to the major tests. Differences between boys and girls for all measures were evaluated for statistical significance by calculation of critical ratios. These showed no differences between the sexes in age, blood level, or family characteristics. Of the 65 performance scores which were compared, only ten yielded critical ratios statistically significant at or beyond the 10% level of confidence. More than half of these were on correlated measures on the color-form sorting task, generally showing that males made more unclassifiable sorts on early trials and more form sorts on later rounds. The other differences showed superior performance by males on cranking and reaction time tasks, possibly because the examiner was an adult male and the boys may have found him more challenging.

Although male-female differences were not found in the critical hematologic, intelligence, and socioeconomic variables, the differences which were found merit a few brief comments. First, the direction of the discrepancies does not indicate that these young Negro males were more vulnerable than females to their impoverished environment. Second, male superiority on tasks administered by adult males indicates that it is important to control for this factor in future research with this population. Apparently, performance by boys and girls on the cranking and reaction time tasks was influenced by different motivational or incentive factors. Lower class children are supposedly more sensitive to social reinforcement; perhaps this is more marked in young Negro males. Finally, results of these comparisons suggest that the relationship between nutrition and behavior might interact with the sex of the subject on some tasks, a possibility which was taken into account in other analyses.

Age Comparisons

In research with children it is often important to examine the relation of each measure to the chronological age of the subjects. As Cravioto and De Licardie (1968) recognize, this is particularly important when the experimental hypothesis is stated in terms of developmental retardation. Such examination can help to demonstrate the developmental nature of the task, and it can provide a way to compare growth trends in different kinds of psychological functions measured by different tasks. It can also establish the utility of each measure for longitudinal research on the same subjects over a period of time. For most of the tasks in the present study, regular improvement from approximately five to twelve years of age was demonstrated in the pilot investigation. However, we felt our results would be strengthened if we could also show improvement over the limited age range represented by our Head Start subjects.

From the age range of about 53 to 67 months we formed three age groups, roughly equal in size, to make our comparisons. Among these groups we found no differences with respect to blood levels or sex distributions, although there was a positive relationship between age and the number of siblings. Most of the performance measures showed a strong age-related or developmental component. The weakest results in this respect were obtained on the moral judgment and color form tasks, apparently because these preschool children were too young for the judgmental sophistication needed to make a high score. Piaget (1932) has maintained that the conceptual orientation required for more sophisticated moral judgment does not occur until age nine or ten, but differences in Piaget's procedure and the one used here gave reason to believe it could be demonstrated earlier. (Crowley, 1968, has evidence that this is possible.) The main reason for including the test in the battery was the expectation that performance on it would be especially sensitive to child-rearing factors. The results indicate that modifications are required if the measure is to be used with this population. In the color form task there was a tendency for errors (unclassifiable sorts) to decrease with age; however, the expected increase in form sorts was not obtained.

Both the Kahn (KIT) and the Van Alstyne intelligence tests showed that mental age increased with an increase in chronological age; however, the IQs for both tests declined. Evidently, the rate of mental age increase in our subjects was slower than in the test standardization samples, which apparently did not include underprivileged children. Other investigations have demonstrated that IQ differences between privileged and

underprivileged groups increase with age, but they have not shown decrement of this magnitude over such a limited age range. The greater decline in IQ over age for the Van Alstyne Vocabulary Test seems to bear out the expectation that the KIT is a more "culture fair" measure. All of the tests in the second battery showed age-related improvement. Older subjects recalled more cards correctly, responded more quickly on the reaction time tasks, and cranked longer (but not faster) than did the younger children. Apparently, in this sample, endurance varies with age as does reactivity, learning, and recall ability.

The performance of children of different ages was compared to ascertain the extent to which each score can be interpreted as an index of psychological development. Evidence of a relationship between performance and age for this limited range provides a strong basis for interpreting any nutritionally related behavioral decrement in terms of psychological retardation. The results of the foregoing comparisons indicate that most of the tasks adopted have a strong developmental component except for the moral judgment and sorting tasks. To the extent that these are poor measures of psychological development at this age level (or are simply less reliable measures) they should reveal little, if any, relationship to the nutritional status of the child. Evidence of such relationship will be examined in the next section.

Comparisons between deficient and normal children

It has frequently been assumed that nutritional anemia is more prevalent in children from low income groups and among non-Whites than in the general population. Because Project Head Start was designed as a social intervention program to assist children who were predominantly in these categories, physical examinations are routinely conducted. However, mass screening of 7000 children in the first year of the program failed to reveal the expected large percentage of children with iron-deficiency anemia. Commenting on this finding, Pearson, *et al* (1967) noted that regional differences were somewhat obscured in the national figures. The selection of head start children for the present investigation was based upon evidence that the incidence of iron-deficiency anemia was relatively high in children from New Orleans who were enrolled in this program. Table 1 provides a comparison of the percentages of children from different regions classified as deficient on the basis of three different norms for hemoglobin. Results from the Washington, D.C. survey were taken from a report by Gutelius (1969). The other results were obtained by the Tulane field team. The lowest cutoff point, 10.0 gm/100 ml, has been a standard advocated by the Children's Bureau and the Interdepartmental Committee on Nutrition for National

Defense. The figure of 11.5 gm/100 ml was adopted by a special study group of the World Health Organization in 1959, and the level of 10.5 gm/100 ml has been suggested by Guest and Brown (1957) as indicating significant anemia.

Several investigators (i.e., Mickelsen, *et al*, 1970; Unglaub, 1968) have discussed the problem of selecting an acceptable standard for identifying anemic individuals and have pointed to the differences in incidence of anemia as judged by different norms. The discrepancy among standards cited by different authorities and agencies raises issues which cannot be resolved here. This problem resides primarily in the fact that the norms are used in different contexts and for different purposes. Recognizing this, the validity of the standard depends on its utility in that situation. The major concern of the present investigation is the identification of adequate means of categorizing or grouping subjects on the basis of hematologic levels to evaluate the relationship between indices of nutrition and psychological functioning. Nevertheless, the results to be discussed are based upon comparisons of groups formed by different standards which seem to have some claim to clinical validity.

From the data entered in table 1 it is apparent that the number of deficient cases is strikingly different under the three standards. Because the number of cases is smaller, reliability of the means for the Children's Bureau deficient may be less than for the World Health Organization deficient; nevertheless, the number of deficient subjects is probably adequate for an investigation at this stage of sophistication and compares favorably with the number of cases at a single year of age in studies reported by Cravioto (1966), Klein (1969), Brockman (1966), and Werkman (1964). The best estimate of reliability is provided in the tests for statistical significance of differences between groups in which uncontrolled variance is reflected in the size of the error

TABLE 1

Comparison of percentage of children in New Orleans and other samples below different hematologic values*

Sample	Hemoglobin gm/100 ml				Mean hematocrit
	Total N	Below 10.0	Below 10.5	Below 11.5	
New Orleans	469	11.7	29.6	57.3	37.2
Alabama	249	2.0	8.0	43.5	36.0
Mississippi	160	3.1	10.6	47.6	36.0
Washington, D.C.	68	5.9	26.5	57.4	34.1

*10.0 ICNND and Children's Bureau norms prior to 1970

10.5 Suggested by Guest and Brown (1957)

11.5 World Health Organization norms, 1959

term. Because of the exploratory nature of this research and the wide implications of the relationship between nutrition and behavior, all indications of such a relationship will be noted, and differences at the 10% level of confidence will be considered significant.

A comparison of groups defined as deficient and normal on the basis of World Health Organization (WHO) and Children's Bureau (CB) norms revealed no significant difference between chronological age (CA) for the two CB groups, but the mean CA for the WHO deficient group was about one and one-half months greater than for the normal group. In view of the strong relationship between age and performance noted earlier, it is obvious that any differences in favor of the normal children in the WHO comparisons would be reduced by the age difference. For this reason primary consideration was given to the comparisons based on the CB and the Guest and Brown standards. These comparisons of performance, displayed in table 2, show that the deficient subjects scored significantly lower on the vocabulary test and also lower on the KIT; however, the difference is not statistically significant in the latter case. The moral judgment scores are slightly higher for the low hemoglobin group, but again the difference is not statistically reliable.

The sorting task measures are not included in table 2 but should be mentioned. The scores on the five trials showed no

TABLE 2
Performance scores of children classified as iron deficient and normal by hemoglobin level

Measure	Deficient (< 10 gm/100 ml)			Normal (≥ 10 gm/100 ml)		
	Mean	S.D.	N	Mean	S.D.	N
Van Alstyne MA	48.1	5.5	29	51.5	7.6	260
Van Alstyne IQ	73.9	9.1		79.4	11.8	
KIT MA	51.7	9.4	32	53.2	9.1	263
KIT IQ	85.5	15.1		89.3	16.5	
Moral judgment	3.8	1.7	24	3.3	1.4	106
Attentive recall						
No. cards	1.6	1.4	34	1.7	1.4	285
Latency	10.9	13.0		8.4	9.7	
Cranking						
Revolutions	37.4	36.5	32	29.5	25.9	259
Total time	72.3	65.0		54.1	46.6	
Light on	67.9	64.9		49.4	45.3	
Reaction time						
Simple	.35	.27	29	.92	.37	253
Disjunctive	1.07	.32		1.06	.32	
Associative	1.65	.99		1.34	.82	

consistent difference in favor of either group with respect to an emphasis on form or color as a basis for sorting, and associated standard deviations tended to be high. This partially reflects the fact that these subjects were not yet old enough to display a consistent preference. To an undetermined extent, however, the variability was amplified by the increasingly complex task demands made under distracting test conditions. It is possible that a combination of these factors was expressed in the shorter time spent on sorting on four of the five trials by the deficient subjects and in their greater homogeneity with respect to sorting time. Since the only meaningful difference was obtained on sorting time, in spite of extensive examination of scores based on type of sort, it is tempting to conclude that the low Hb subjects may have been less motivated to work at this task.

On the second battery of tests none of the differences between deficient and normal children reached statistically significant levels; however, several of the trends are noteworthy. The most interesting of these show that the anemic subjects tended to take longer to respond in the attentive recall task, to work longer at the cranking task, and to have slower mean reaction time on the associative reaction time task. An additional series of analyses was made in which subjects with hemoglobin levels below 10.5 gm/100 ml were classified as deficient. This increased the differences revealed in earlier comparisons. Results of these analyses showed significantly better performance by the subjects with adequate blood levels on both the Kahn and Van Alstyne intelligence tests, and also on total latency on the associative reaction time task. The *t* values for the comparisons involving KIT IQ, Van Alstyne IQ, and Associative RT, respectively, were 2.3, 2.8, and 2.4, with *df* greater than 60 in all cases.

In the results considered here, the intelligence and Associative RT measures showed consistent differences in favor of the normal subjects in comparisons based upon both of the more conservative hematologic standards without confounding sex or age factors. To evaluate the interaction between age and blood level, subjects classified as deficient (below 10.5 gm/100 ml) and normal were divided into the three age groups used for the comparisons reported earlier. Table 3 displays means and standard deviations for the tasks showing the strongest relationship to blood levels in the overall comparisons, the two intelligence tests and the Associative-RT task. Mean hemoglobin and standard deviation for each group of subjects is given at the bottom of the table. Within each age group the difference between mean Hb for low (deficient) and normal groups is highly significant. The number of subjects for which mean hemoglobin is shown was greater than the number of cases in the comparisons involving the

psychological scores, because all tests were not administered to every subject. For this reason the number of cases in each group is entered separately for each variable.

In the results discussed earlier both measures of intelligence showed increases in mental age over the three age groups which were less than the expected norm. This was reflected in a general decline in IQ with age. This raises two important questions: 1) whether this trend is different for the nutritionally deficient and normal subjects, and 2) whether the interaction between hemoglobin and age is different for the two intelligence measures. Evidence of greater IQ decline for the deficient children might indicate that the effects of iron-deficiency anemia are stronger in older subjects or that the effects on intellectual function are cumulative. Similar trends for the Van Alstyne and KIT would provide evidence that nutrition affects general intelligence, while different trends might suggest that other variables are involved, or that only specific functions are affected.

The mean IQ for the Kahn Intelligence Test (KIT) and the Van Alstyne Picture Vocabulary Test (VA) for children classified as deficient and normal in each age group is displayed graphically in figure 1. A comparison of Graphs A and B reveals that the VA IQ was lower than the KIT IQ at the youngest age, and that it decreased more sharply with age. In addition, although the IQ for the deficient children was generally lower in all cases, the difference in the IQ between lows and normals was greater in each group for the VA. Statistical comparisons within the age groups disclosed that the only significant difference in KIT scores between hematologic groups occurred in Age Group II ($p < .10$), while the differences at all three age levels are significant for the VA IQ ($p < .05$). Both tests seem to show greater "decline" in IQ for the iron-deficient subjects, but this is especially marked with the VA, which measures verbal achievement. Since there is a positive relationship between verbal ability and social class, the differences on this measure may, in the main, reflect the effects of home environment. These factors in the home would also be correlated with the dietary and health practices responsible for iron-deficiency anemia. However, because both measures indicate that the deficient subjects are less intelligent than the children with normal hemoglobin levels, we would expect to find related differences in learning ability. In fact, if the differences in intelligence were not reflected in differences in learning or adaptive behavior, their significance would be severely limited.

The only task used in this study which gave a suitable measure of learning was the associative reaction time task, in which the subject was trained successively to associate each of

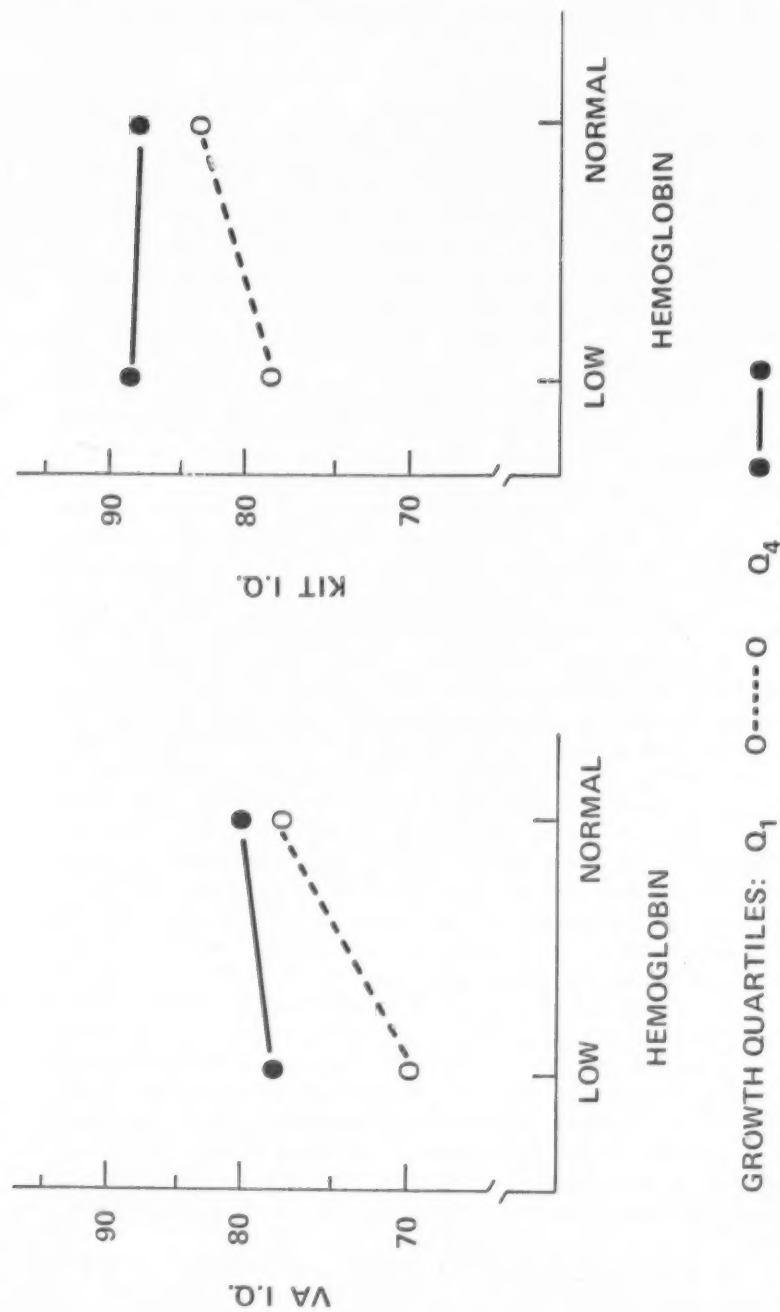


FIGURE 1. Mean IQ on the Van Alstyne (VA) and Kahn Intelligence Test (KIT) for children with low and normal hemoglobin levels in three age groups.

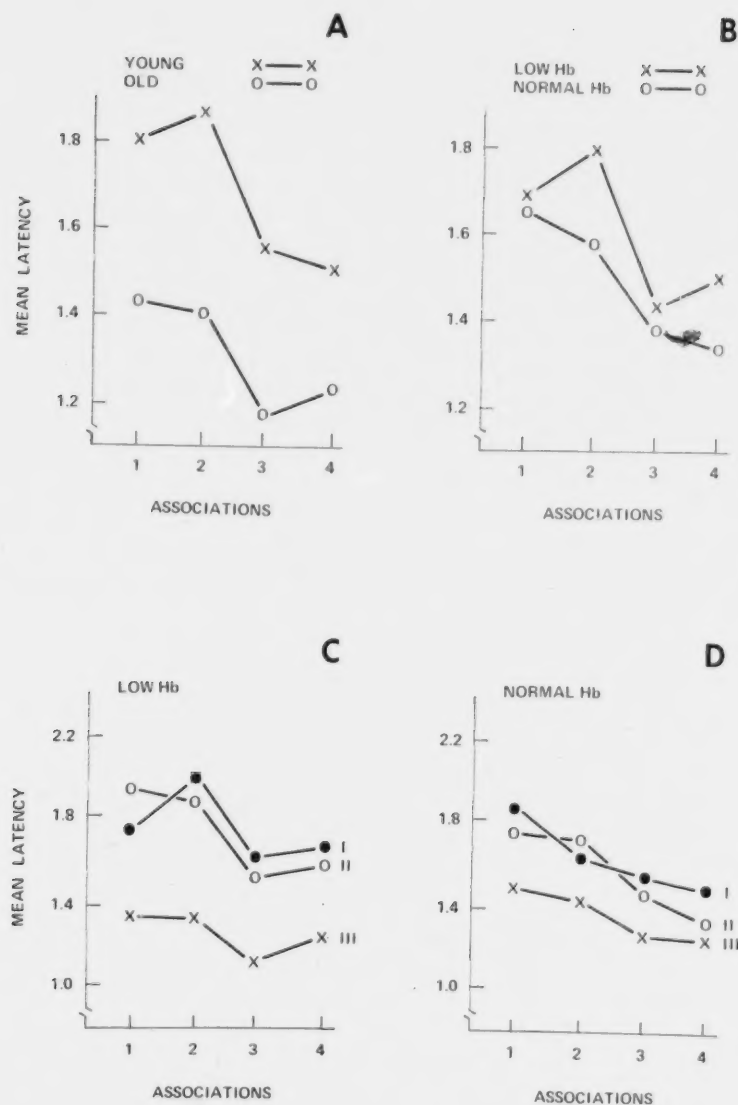


FIGURE 2. Mean latency of the correct response on four successive associations on the Associative Reaction Time Task. Graphs A and B compare these results for the subjects in the youngest and oldest age groups and for subjects with low and normal hemoglobin (Hb) levels. Results for the three age groups with normal and low Hb groups are displayed in the lower graphs. Mean age for Groups I, II, and III, respectively, is 56, 59, and 64 months.

four response panels with one of four stimulus panels. Because there was a discrete number of associations to make, each pair learned gave the child increased information about the remaining pairs. Therefore, learning would be reflected in progressively reduced errors and shorter latency on later training trials.

Because differences in the level of performance were most clearly revealed in early trials on each association, mean RT for the first three trials on each association was calculated for each subject. In the two lower graphs (C and D) in figure 2 mean latency for each successive association is shown for children in three age groups with low and normal hemoglobin. The exact values of the means and standard deviations are given in table 3. For comparison, mean RT for the four associations for the oldest and youngest groups and for subjects with low and normal hemoglobin are displayed in the top two graphs (A and B) in figure 2. An examination of the lower graphs discloses that the performance by the two younger groups of low hemoglobin subjects was highly similar, while RT for the oldest group (Group III) was much better at all four associations. For all three deficient groups there is only a slight indication of progressive improvement, mainly between Association 2 and 3, and some indication

TABLE 3
Comparisons of performance of children with low and normal hemoglobin in three age groups

Measure	Age groups					
	I (53.7-57.3)		II (57.4-61.7)		III (61.8-66.7)	
	Low	Normal	Low	Normal	Low	Normal
Van Alstyne IQ	79.3	83.4	74.9	80.7	71.8	77.1
S.D.	6.7	11.3	10.2	11.5	9.2	12.6
N	19	60	32	80	24	73
KIT IQ	91.7	90.3	86.2	91.3	85.7	86.7
S.D.	13.9	17.7	17.6	17.3	12.3	15.4
N	18	63	30	80	26	17
Associative RT						
N	18	58	26	79	27	41
Block 1	1.76	1.85	1.94	1.74	1.36	1.49
S.D.	.99	1.18	1.26	1.51	.97	.86
Block 2	2.10	1.62	1.89	1.70	1.38	1.45
S.D.	1.98	.86	1.34	1.17	.58	.82
Block 3	1.60	1.54	1.52	1.47	1.14	1.22
S.D.	1.13	.78	.48	.89	.46	.90
Block 4	1.61	1.49	1.62	1.32	1.26	1.22
S.D.	.90	1.16	.93	.59	.61	.79
Hb MEAN	9.86	11.79	9.95	11.95	9.79	11.67
S.D.	.69	.97	.51	.74	.75	.66
N	27	83	41	113	38	97

of deterioration on the last association. In contrast with the deficient groups, the three groups of normal subjects revealed highly similar trends and displayed a more regular improvement over successive stages of training.

Two features of these results are noteworthy; the consistently large difference in performance between the oldest and the two youngest deficient groups over all stages, and the indication that the normal children made greater use of the information available as training progressed. The similarity of performance by the oldest group of deficient and normals and the inferior performance by the younger groups of lows suggests that maturation or some other age-related factor overcomes the nutrition-related decrement on this particular task. The contrast between the irregular trend of the deficient subjects with the regular improvement of the normals suggests several possibilities. Since the form of the curves, as much as the overall levels of performance, points up differences between iron-deficient and normal subjects, it is possible that the irregularity reflects the fact that fewer cases were included in the low groups. Examination of the standard deviations entered in table 3 does not provide strong support for this. Except for a few cases there are no sizeable differences in the standard deviations; these exceptions suggest that the youngest group became more variable on the last block of training trials, in which performance of all three low groups deteriorated. Graphs A and B, at the top of figure 2, provide additional insight into the differences. The developmental nature of the Associative RT task is dramatically illustrated in the comparison of the youngest and oldest groups (Graph A) which shows shorter latencies for the latter at all four associations. Although both groups show overall improvement, some performance deterioration is evident at the second association for the young subjects and at the last association for the oldest group. An examination of Graph B reveals that each of these performance irregularities occurred in the anemic group, while RT for the children with normal blood levels shows a smooth, progressive decrease.

At the risk of over-interpreting the relatively small differences in these results, it is tempting to draw conclusions which might provide fruitful hypotheses for further investigation. Two major alternatives seem to present themselves: 1) the smoother progression of the normals reflects their superiority in learning ability, 2) the irregular performance of the low Hb and Hct groups reflects a lower or less sustained level of motivation to perform this task. Factors such as basic differences in reactivity or short-term attentiveness between the deficient and normal children are ruled out by the fact that the deficient groups

were as proficient as the normals on the simple and disjunctive RT tasks. However, the fact that these two tasks appeared earlier in the RT battery, and that they also demanded less learning on the part of the subject, does not provide evidence favoring either of the alternatives stated above. That is, the anemic children might have become more tired or bored or less alert as the RT testing progressed, or they might have had more trouble learning the required stimulus-response relationships. For what it is worth, we can report that the test administrators' comments on general attitude, attentiveness, and cooperativeness revealed no striking differences between deficient and normal children. In an investigation, now in the initial phases, tasks have been included which were designed to permit clearer separation of fatigue and motivational factors from measures of learning and attentiveness. Preliminary results suggest that growth of response decrement, which seems to be based on fatigue, follows different trends for iron-deficient and normal subjects. For example, on early simple reaction time trials the deficient and normal subjects perform at the same level, but under continued testing the deficient subjects show signs of fatigue (or reduced motivation) much earlier than do the normal subjects. To provide more information about the factors underlying this phenomenon, studies will be conducted in which performance will be compared during and after massed and distributed practice on simple and complex tasks.

Physical growth and performance

In many surveys and comparative studies of national health conditions, height has been one of the measures frequently used and cogently defended as a barometer of dietary adequacy. In retrospective studies of nutrition and behavior, height for age has been used as an index of nutritional deficiency by Cravioto and his colleagues (1969), Klein (1969), and Brockman (1966). On the basis of evidence that body size is smaller in environments where nutrition is poor than where nutrition is adequate, investigators have assumed that variations in height within a given age group provide a reasonably valid basis for inferring that nutritional insult occurred earlier in life. The availability of anthropometric and hematologic measures on the children in the present investigation provided an opportunity to examine the relationship between these two indices of nutritional status and to compare the relationship of each to the behavioral measures.

When subjects in the tallest and shortest quartiles were compared, the results (see table 4) showed significant differences on a larger number of performance variables than did any of the comparisons based upon differences in blood level. The results

TABLE 4
Comparisons of mean scores for subjects in upper and lower
quartiles of height distribution

Measure	Q ₁ Short			Q ₄ Tall			t
	Mean	S.D.	(N)	Mean	S.D.	(N)	
Age (months)	58.3	3.16	96	61.7	3.26	97	7.44
Weight (lbs)	34.3	3.45	96	44.4	4.97	97	16.62
Height (cm)	101.2	25.35	96	114.3	23.86	97	37.27
Hemoglobin	11.0	1.15	96	11.4	.96	97	2.35
Hematocrit	36.4	2.98	96	38.0	2.74	97	3.58
Comp. sentences	6.1	2.22	17	8.1	2.69	16	2.25
KIT MA	49.4	9.21	72	53.2	11.31	73	2.23
Van Alstyne MA	48.3	5.70	73	51.2	9.19	68	2.25
Color form—Sort 1	3.0	3.81	70	4.3	3.90	76	2.04
Color form—Sort 2	1.5	1.95	70	2.1	1.98	76	1.90*
Color form—Sort 3	6.0	3.95	70	8.4	6.41	76	2.79
Crank revolutions	25.9	21.63	66	34.5	31.78	59	1.88*
Cards recalled	1.3	1.29	81	1.8	1.30	79	2.20
Food preference	3.6	1.36	81	4.0	1.42	79	1.79*
Reaction time— Errors	.1	.06	71	1.0	.05	63	2.68
Reaction time— Latency	4.0	1.57	71	3.3	1.00	63	3.03

*p < .05, one-tailed test; for other t values p < .025

also revealed that the taller group had significantly higher hemoglobin values; thus height apparently reflects *present* nutritional status, in addition to being useful as an index of past nutritional insult. Taken together, these results seemed to indicate that the relationship between current blood level and psychological functioning might actually be based upon past malnutrition to some extent. However, the fact that differences were obtained between tall and short subjects on mental age but not on the intelligence quotients suggested the need for further analysis. This analysis revealed that, although the age range of the subjects was only about twelve months, the tall children were significantly older (58.3 versus 61.7 months, $t=7.44$). Since results considered earlier showed that the older subjects performed better on practically every task, this last finding suggests that some of the relationship between height and task performance might be due to the correlation between height and chronological age.

In the reports of research using height as an indicator of past nutritional insult writers often use the term "height for

age" without presenting the operational details of the age-matching process. In the absence of standardized procedures an analysis was conducted in which subjects were divided into three age groups, like those used for the developmental comparisons, and then ranked according to height. Comparisons of the tallest and shortest quartiles in each of these age groups, in contrast with those reported in table 4, showed very few statistically significant differences between short and tall subjects, although many were in the expected direction. However, the results still showed that height is related to current blood levels and also to chronological age even when the age range for each group is only about four months. The relationship of height to the hematologic measures in this case increases confidence in its utility as a variable in nutritional research. The persistent relationship between height and age emphasizes the importance of instituting careful controls over age when physical growth is used as a variable, and raises questions about the internal validity of research results in which age control procedures are not explicitly described and evaluated.

Comparisons based on growth and hematologic measures

Height for age and hemoglobin level provide two different kinds of information; the former is an inferential measure of past nutritional insult while the latter is an index of current nutritional status. The positive relationship between these measures in the results just considered indicates that some of the children in this study classified as suffering from iron deficiency anemia might also have suffered malnutrition earlier in life. Ignoring the fact that time and nutritional status are continuous variables and viewing them as dichotomous, four possible combinations are produced:

- I Past and present nutrition adequate.
- II Past adequate and present nutrition inadequate.
- III Past inadequate and present nutrition adequate.
- IV Past and present nutrition inadequate.

Many studies of nutrition and behavior have been aimed at assessing the residual effects of past malnutrition under conditions where the present nutritional status is, or is assumed to be, adequate. Where the current state is determined to be normal through biochemical or other suitable means, condition III clearly obtains. Where such information is not available, or the inadequate dietary intake is not known to be confined to early childhood, it is probably wise to consider the situation as equivalent to condition IV because of the strong possibility of a continuing pattern of malnutrition. This suggests that relationships between

past malnutrition and current psychological decrement reported in some field studies may also reflect the effects of current nutritional state to an unknown extent. It is even possible that inadequate diet at the time of testing may be the primary factor responsible for the observed relationship. In the present investigation the intended relationship is represented by condition II. However, that height and hemoglobin were related indicates that some of the subjects might be representative of condition IV. Thus, the behavioral results reported in this investigation, and in some supposedly retrospective studies, may be based upon the confounded effects of past and present nutritional variables. H. G. Birch (personal communication) has hypothesized that where children have suffered past malnutrition and are currently malnourished, the greatest number of psychological functions would be affected; therefore, the clearest evidence of psychological impairment should be obtained under these conditions. A question of considerable importance is which of the remaining conditions, past malnutrition (III) or present malnutrition (II), exerts the stronger influence on intellectual function.

In selecting an appropriate growth measure to serve as an indicator of past malnutrition such external standards as the Iowa norms and growth data based on other Negro children were not used because the age groupings for these norms were too gross to provide adequate control over this factor. Among possible measures based on internal standards, that is, the relative rank of a child in comparison to his age mates in this sample,

TABLE 5

Mean scores of subjects with low and normal hemoglobin levels in the upper and lower quartiles on the composite growth index

Measure	Low hemoglobin				Normal hemoglobin			
	Q ₁	n	Q ₃	n	Q ₁	n	Q ₃	n
Age (months)	60.4	28	60.2	26	59.4	75	59.6	69
Weight (lbs)	32.5	28	43.2	26	33.8	75	46.7	69
Height (cm)	101.6	28	111.4	26	102.5	75	113.5	69
Van Alstyne IQ	68.9	17	78.3	19	78.5	61	80.4	48
KIT IQ	78.9	16	88.6	18	84.5	61	88.1	50
No. Cards	1.4	24	1.7	22	1.5	60	1.7	54
Cranking	24.1	22	24.1	18	27.0	56	28.6	48
Simple RT*	1.99	22	1.89	15	1.90	54	1.93	45
Disjunctive RT*	2.04	22	1.97	15	1.98	54	2.02	45
Associative RT	2.59	22	2.59	15	2.56	54	2.51	45

*Log of mean simple and disjunctive RT is shown

Note: For low hemoglobin group Hb was 10.5 gm/100 ml or less; for normal group, Hb was greater than 10.5.

For physical growth (PG) groups, Q₁ designates the lower quartile; Q₄ designates the upper quartile.

height within small age groups and the raw ratio of height to age were not used because they revealed some residual relationship to age or possessed poor scale properties or were related to hemoglobin levels. To avoid these biases, a composite score was adopted which is based upon two normalized indices of growth similar to measures utilized by Rafalski and Mackiewicz (1968) in a correlational study of somatic development and sociometric status in Poland. For each subject in the present investigation the ratio of height to age and weight to height was calculated. The z-scores of these two ratios were then added to provide an index of physical growth (PG). Intercorrelations computed for PG and other variables revealed that it was independent of age and hematologic status and that it was strongly related to other measures of growth. Two groups of subjects were identified who were in the highest and lowest quartiles in the PG distribution. These two groups were then further divided into low hemoglobin (10.5 gm/100 ml or less) and normal hemoglobin (greater than 10.5 gm/100 ml) groups. For these four groups, means and standard deviations were calculated for all major performance measures. Table 5 displays the most important of these results.

An examination of table 5 reveals virtually no age bias among the groups, since all means are within a one-month range. Weight and height measures show the expected positive relationship to the growth index. Among the psychological variables, the intelligence tests produced the only statistically significant differences among the groups, although the Attentive Recall and Cranking tasks reveal suggestive trends. The IQ results on both tests show a strong interaction between physical growth and blood level, a relationship which is graphically displayed in figure 3. As expected, a combination of inadequate nutrition in the past and present (low hemoglobin and physical growth) produced the strongest evidence of psychological decrement on both measures of intelligence.

Short anemic subjects scored ten points lower on the Van Alstyne test than did the tall anemic subjects, and twelve points lower than children with normal blood levels and growth. On the KIT there was no difference between anemic and normal groups at the top growth quartile, but IQ for the short subjects with normal hemoglobin was four points lower and for the short iron-deficient subjects was ten points lower. No differences related to growth were found in reaction time measures, but small suggestive differences appeared on the attentive recall and cranking tasks. Fewer cards were recalled by the smaller subjects regardless of blood level. Children with normal blood levels cranked longer than the deficient, but there was no difference

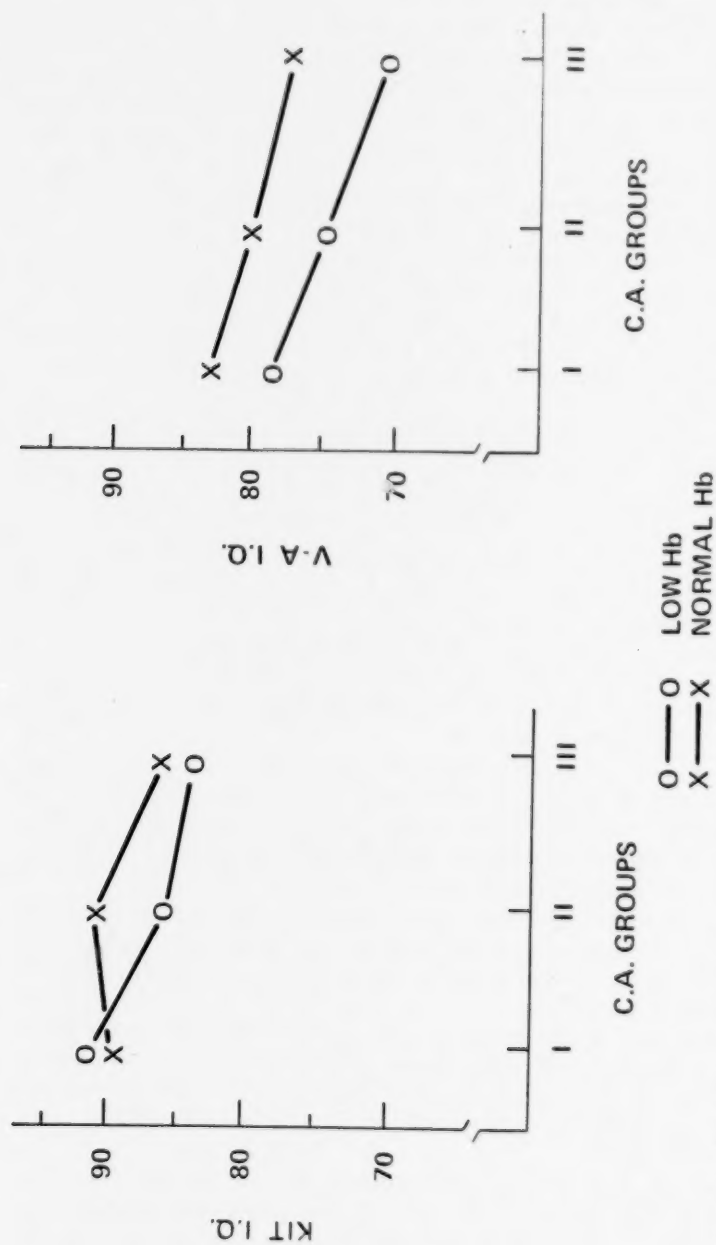


FIGURE 3. Mean IQ on the Van Alstyne (VA) and Kahn Intelligence Test (KIT) for subjects with low and normal hemoglobin levels in the upper and lower quartile on the physical growth index (PG).

related to physical growth. Otherwise, most of the results support the conclusion that the effects of current malnutrition are most evident in children whose physical growth is less than that of their age mates. When physical growth is adequate, current blood level appears to have little bearing on intellectual function. To a large extent, it also appears that the relationship between growth and intellectual capacity is weak except in subjects who are currently deficient.

As they were operationalized in this investigation a combination of past and current malnutrition indices show the greatest negative effect upon intellectual level. Considered separately, however, current malnutrition apparently has less decremental effect than past malnutrition on current psychological functioning. To the extent that this represents an internally valid outcome, several reasons may be advanced to account for it:

1. Iron-deficiency anemia may exert only weak effects on performance and these effects are not particularly obvious in this investigation. Other subjects, other measures of behavior, or other kinds of acute deficiency may reveal stronger differences.

2. Past malnutrition, as indicated by growth retardation, probably represents a much deeper level of pathology than the mild iron-deficiency anemia in the present study. As Scrimshaw and Gordon (1968) have suggested, retarded growth may reflect not only primary malnutrition occurring at an early age but may also stem from chronic malnutrition or secondary malnutrition related to recurring illness.

3. The apparent strength of the relationship between past nutritional status and intellectual function may be primarily due to a relationship between height and adverse familial factors, as noted by Pollitt (1969), and poorer potential at birth, i.e., congenital intellectual inferiority.

4. Height comparisons may reflect greater experimenter expectancy bias than does the comparison based upon blood level because height is more visible. That is, an examiner might assume that a tall child is older and expect him to perform at higher levels, and he might expect a lower level of performance from a smaller child. This factor is present in all investigations using height as a basis of classification and, to the extent that height is positively related to actual intellectual ability, it is difficult to assess.

In selecting intelligence measures for use in this investigation, the Van Alstyne and the KIT were included because they represented two kinds of tests, the VA stressing verbal achievement and the KIT stressing more basic conceptual and com-

prehension skills. The latter was described by its author as a "culture free" intelligence test, and although this claim may be excessive, the superiority of KIT IQs over VA IQs suggests that it is more "culture fair" than the VA for this population. This introduces the possibility that the Van Alstyne is more strongly related to socioeconomic and familial factors, and to those aspects of verbal behavior which Bernstein (1962) suggests are tied to social class. That the major difference between deficient and normal hemoglobin groups occurred with the Van Alstyne test, while differences based on the extreme growth groups were found with both VA and KIT, indicates that these two indices of nutritional status may also be differentially related to social class variables. These possibilities are considered in the next section.

Evaluation of social factors

Many investigations of the relationship between nutritional and psychological variables have been criticized or commended for the manner in which the socioeconomic variables or social class factors have been controlled or evaluated. For example, Scrimshaw and Gordon (1968) note editorially that groups of "malnourished" and "well nourished" children in the Stoch and Smythe (1968) study are distinguished by large environmental as well as nutritional differences. They cite with approval Cravioto and De Licardie's (1966) search for an association between their index of malnutrition (short stature) and factors such as family income, housing and hygienic conditions, and parents' education. Although the importance of social influences is well recognized by investigators in this field, there is not total agreement concerning the appropriate model of relationships among social, nutritional, and psychological variables. In Cravioto's models, Scheme I shows social conditions as independently causing malnutrition and poor psychological development; Scheme II shows social conditions resulting in malnutrition which, in turn, is responsible for the decrement in physical and intellectual development. Scrimshaw and Gordon point out that a more likely alternative is that social conditions and malnutrition influence psychological functioning independently and also in interaction with one another. The most complex view is advanced by Richardson (1968) and Kallen (1968) in models which assume interdependent interaction among social, nutritional, and psychological factors. The available evidence seems to support this last interpretation. To completely rule out the contribution of social factors to the relationship between malnutrition and behavior, except from a purely operational point of view, would require a level of experiential information which is simply not availa-

ble. Nevertheless, it is possible to obtain information which would reveal whether the social environments of malnourished and well nourished groups of subjects differ to such an extent that differences in their behavior can be accounted for primarily on this basis.

In the present study, several characteristics of the children's familial situation were determined at the time they were tested. Generally, these were factors most subject to change over time, such as number of siblings, size of household, head of household, and occupation of household head. Several months after the children were tested, extensive interviews were conducted with the parents (or adult caretakers) of almost all the children with low Hb levels ($N=33$) and approximately twice that number of caretakers of non-anemic children who lived in the same neighborhood. All interviews were conducted in the children's homes by a trained Negro female interviewer who identified her association with the nutrition project and expressed a desire to obtain additional information about the head start child. The topics covered included parents' educational and occupational status, household size, rent and other housing characteristics, health factors, parents' educational and occupational aspirations for the child, and scales designed to measure aspects of the caretaker's social outlook and child-rearing practices. In over eighty percent of the cases the mother was the person interviewed, and in most of the remaining cases some other adult female relative who cared for the child provided the information.

With the exception of a significantly lower educational attainment for the fathers of children with iron-deficiency anemia, and some nonsignificant trends in housing characteristics, the results did not support the conclusion that differences in social environment account for the inferior performance of the children with low hemoglobin levels. Cravioto and De Licardie (1966), in discussing the positive correlation they obtained between mother's education and neurointegrative function, point out that the mother's greater responsibility for child care, health, and diet places her in a critical position to influence the physical and psychological development of the children in her household. This is no less true of Negroes living in New Orleans than it is of rural societies in Latin America. In fact, Negro family structure in the United States has been characterized as matriarchal, a label not ordinarily applied to Latin American families. These considerations do not reveal an obvious mechanism by which the fathers' educational level might exert a detrimental effect upon the child's nutritional level and psychological function in the absence of additional negative characteristics. Richardson (1968) has reported positive relationships between a man's social class

and the intelligence of his grandchildren, but this effect is mediated by the mother. It is, of course, possible that fathers are more potent determinants of such outcomes in Negro families than in other families, but this has not been demonstrated previously.

Results reported earlier compared the performance of anemic and normal children in the upper and lower quartiles on the composite physical growth index. Data from the interviews were grouped in the same way to assess the possible contribution of social factors to the observed differences in the intelligence scores. Although this reduced the number of cases in the physical growth (PG) quartiles for low hemoglobin to a point where reliability is very weak ($N=9$), there may be some value in briefly reporting the results. Most of the differences failed to show a regular progression matching hypothetical levels of nutritional insult; however, comparisons of the extreme groups, low hemoglobin low physical growth and normal hemoglobin high physical growth, provided some evidence that the former is more "disadvantaged." To the extent that these results are valid, the families of this group have more children, larger households, pay higher rent, and are less well employed and educated. Because the number of cases in the low-Hb low-PG group is so small, these differences should be taken only as suggestive; however, the consistency of the direction of the differences tends to increase confidence in them. Since both slower growth and lower hemoglobin levels are assumed to reflect poorer health and dietary conditions, it would be surprising if no related differences appeared in environmental and SES factors.

The results presented here support the conclusion that multiple deprivations exert some kind of additive (or multiplicative) effect on psychological function. In the general population it is possible that a single nutritional factor such as dietary anemia, acting alone, may not be revealed in behavioral decrement because other more powerful sources of variability mask its effects. In field situations the relationship between nutrition and behavior is studied in lower class populations because that is where the malnutrition is most likely to occur. Some writers have suggested that the ideal field situation for studying this relationship would be one in which there is nutritional deficiency without social deficiency. This may be the ideal way of determining the behavioral potency of various types of nutritional deficiency. However, research in such a situation might only reveal that inadequate diet (except at extreme levels) must interact with inadequate environment to produce lasting reduction of intellectual function. The data available at this point in time indicate that this is probably the case. As scientists, the important task before

us now is to identify the factors which engage in this interaction and the nature of the psychological decrement which it produces.

Results of the present investigation indicate that intellectual decrement of a generalized nature occurs primarily in children who display symptoms of both present and past malnutrition. They further indicate that the major behavioral sign of current malnutrition is reduced attentiveness, motivation, or resistance to fatigue. These findings suggest that measures of different kinds of psychological process might be emphasized depending upon the nature of the design and whether past, current, or continuing nutritional insult is under investigation.

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NOTE: The research described in this paper was supported by grants from the Office of Economic Opportunity through the Early Childhood Research Center of Tulane University, Shuell Jones, Director. Principal investigators during this period were the late Walter Unglaub, M.D., Jefferson L. Sulzer, Wesley J. Hansche, and Fredrick Koenig. Field research in nutrition was under the direction of Dr. Patrick Morgan and Ann Metzinger; the behavioral team in the field was under the direction of Janet Blumenthal, Jim McDaniel, and Charles Rubio. We wish to express our gratitude to the directors and teachers in the participating Head Start Centers for their patience and friendly cooperation.

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NUTRITION AND BEHAVIOR: PRACTICAL PROBLEMS IN FIELD STUDIES IN AN URBAN COMMUNITY

by

Fernando E. Monckeberg*

Many authorities point out the higher frequency of mental and motor retardation in lower socio-economic groups characterized by poor nutrition, as well as economic and cultural marginality (Cravioto and Robles, 1965; Monckeberg, 1968). This problem is extremely important in underdeveloped countries, where a large portion of the population live under marginal conditions. Moreover, it presents difficulties to the progress of these countries since this retardation interferes with the integration of these groups into programs intended to promote socio-economic development. The scientific and technological revolution has created many significant changes in society. The integration of the individual into this changed society requires the total development of his physical and psychological capacities (Monckeberg, Donoso, Valiente, Arteaga, 1967). Poverty and malnutrition appear to interfere with this development.

The importance of this problem explains the development, in recent years, of different levels of research on nutrition and its associated factors. First, it is necessary to know the magnitude of the problem. Then, the different factors which relate to it must be analyzed. Finally, it must be determined if the damage which occurs is reversible or not. It is relatively easy to design animal studies to specify the effects of different nutritional factors on brain composition or on behavioral development. But when we come to human beings, the subject is more complicated. On the one hand, there are many different factors which interfere with mental development. On the other hand, a simple and accurate methodology for evaluating the different etiological factors and consequences does not exist.

In nutritional surveys conducted in Chile we have demon-

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strated a reduced growth and a slower maturation rate in preschool children in the lower socioeconomic groups. At the same time, we have shown a higher frequency of retardation of mental and motor development as measured by many classical psychological tests (Monckeberg, 1968; Monckeberg, Donoso, Valiente, Arteaga, 1967; Gesell and Amatruda, 1962). With the present experimental data it may safely be assumed that the retardation of growth and maturation is the consequence of chronic malnutrition. This certainly does not exist with the mental and motor retardation; there are many environmental factors that may have a negative influence on intellectual capacity. Those social groups suffering from malnutrition are precisely those which are outside the main flow of society, with very low educational, cultural and sanitary levels. All these factors contribute to the presence of this so-called 'underworld' that restricts adequate stimulation for mental development.

In addition, there is evidence from our studies and from others of central nervous system involvement in cases of severe malnutrition. The severely malnourished infant shows lack of interest in the environment, responds to stimulus with a monotonous cry. Many electroencephalographic disturbances have been described. Significant atrophy has been observed in the brains of children who died from malnutrition. This atrophy has been associated, as well, with biochemical alteration in the composition of the brain tissue, in DNA, RNA, protein and lipid contents. At this point, we do not know whether this brain pathology is also involved in those more frequent instances of malnutrition where the major evidence of pathology is a lower rate of growth.

Life Conditions and Mental Performance

Some years ago, in an attempt to analyze the effects of malnutrition on mental capacity, we studied 500 preschool children in the city of Santiago. These children belonged to three different groups: (see figure 1)

Group A consisted of middle class children who were not malnourished. The average family income was about \$228 per month, and both parents had, on the average, a secondary education. The physical growth curves of the children were average.

Groups B and C were lower class children. The average family income was about \$70 per month, and the parents had, on the average, about two years of schooling. Group B had participated for a period of ten years in a program of nutritional supplementation with milk, and well organized free medical care.

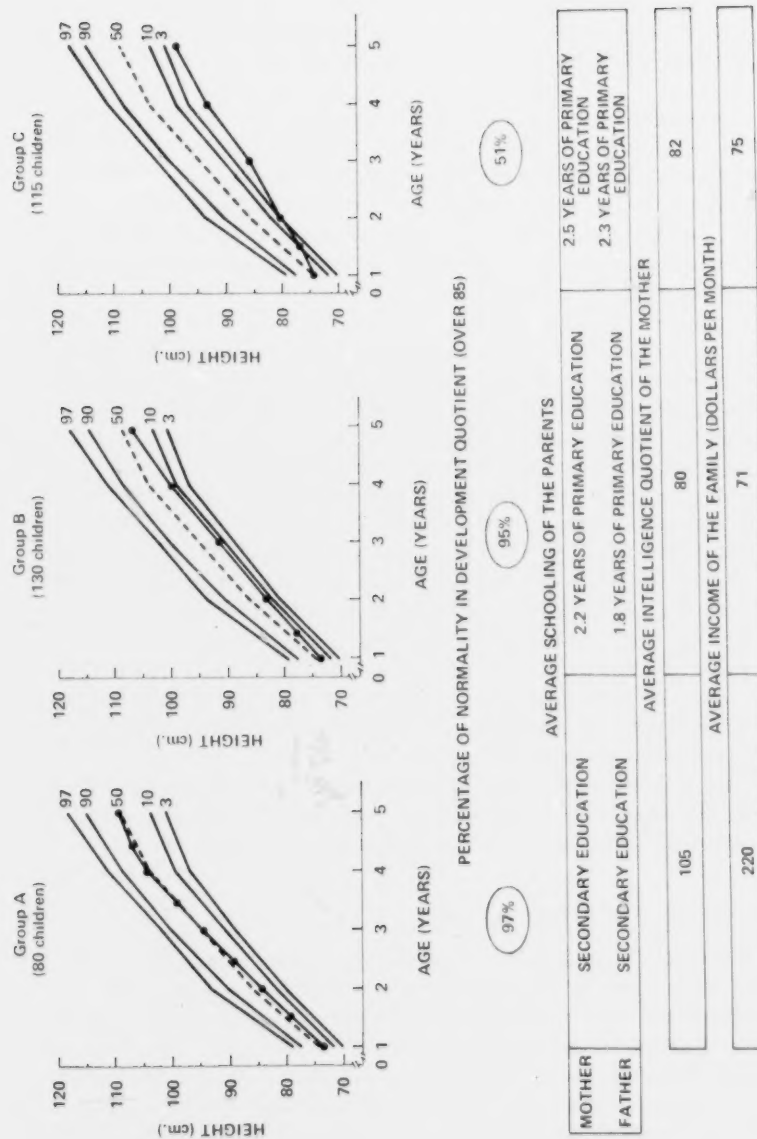


FIGURE 1. Development quotient of preschool children (Gesell test) from three different areas of Santiago, with different nutritive and socio-economic conditions.

Thus, this group presented little or no malnutrition, and physical growth, while perhaps somewhat below that of group A, was still within normal limits. Group C did not receive adequate medical care. The malnutrition of group C is demonstrated by the poor physical growth, with the average height at one year of age being below the third percentile of the Iowa norms. (figure 1).

The Gesell test was used to measure mental development in these children. Using a score of 80 as indicative of mental subnormality, groups A and B had a subnormality rate of 3% and 5%, while group C had a subnormality rate of 40%.

These results would appear to support the existence of a relationship between nutrition and intellectual development since the test used gave normal results for groups A and B, which were well nourished, and differentiated between groups B and C, which were of similar socio-economic circumstances but differed in nutritional status. Group C, with its high incidence of malnutrition, also showed a high incidence of mental subnormality, although it was socioeconomically similar to group B.

In spite of this, we realized during the experiment that we could not conclude that the difference in intellectual performance among the groups was due to nutritional differences. The supplemental feeding and medical care program changed not only the nutritional status but the total environment, including cultural and maternal motivations. Besides this, although groups B and C were only ten blocks apart, group C was in a slum section, with most of the families having migrated to the city from rural areas over the last ten years. Obviously, the cultural background, beliefs, and traditions of the two groups were different, although income and education were similar.

This experiment helps to demonstrate the difficulty in separating the effects of malnutrition on mental capacity even in well planned studies of apparently homogenous populations.

Studies in the Slum Areas

With this experience, we designed another study in a homogenous slum area of Santiago where malnutrition was prevalent. The objective was to evaluate the influence of malnutrition on the developmental quotient of preschool children. We took a representative sample of 150 children between two and four years of age. Measurements included: 1) anthropometric measurements, 2) medical examinations, 3) psychological development, with the Gesell used for children one to three and the Terman-Merrill scale for children three to five, (Terman and Merrill, 1962), 4) the intellectual level of the mother, as determined by

the Wechsler scale (Wechsler, 1955), and 5) assessment of nutritional intake (Arteaga, Rosales, Micheli, Castro, Barja, Tapia and Valiente, 1968).

As in previous studies, the children showed a high incidence of psychomotor retardation. We looked for correlations in four different areas:

1. Two extreme groups of children were separated according to nutritional status: one group whose weight was below the 3rd percentile (Iowa scale), thus indicating definite growth retardation, and those who could be considered nutritionally normal as indicated by their being over the 10th percentile in weight. These results are given in table 1. There are significant differences in performance on all five areas of intellectual performance (motor, language, adaptive, personal-social and general) between the mal- and well-nourished children, with the well nourished children performing better in all instances. Nevertheless, even the well nourished children presented lower values in all areas than the children from groups living under better socio-economic conditions in other parts of the city.

2. Figure 2 shows the correlation between physical growth and developmental quotient for children between one and three years of age. To calculate the correlation they were divided into two groups, depending on the presence or absence of growth retardation. The statistical relationship between growth retardation and impairment of psychomotor development is highly significant. This correlation disappears when growth remains within normal limits. In this low socioeconomic group growth retardation is due mainly to malnutrition, and the degree of retardation is proportional to the malnutrition. Hence, we assumed that there was a positive correlation between the degree of under-nutrition and retardation of mental development. Nonetheless, these findings do not indicate that this is the only factor involved, since even in these slum areas with their homogenous population we

TABLE 1

Development quotient in well nourished (weight for age over the 10th Iowa percentile) and malnourished (weight for age under the 3rd Iowa percentile) children of a close population (slum area).

Area	Malnourished (96 cases)	Well nourished (24 cases)	P
Motor	72 $\pm$ 12	93 $\pm$ 12	< 0.001
Language	68 $\pm$ 15	79 $\pm$ 14	< 0.001
Adaptative	74 $\pm$ 11	86 $\pm$ 11	< 0.001
Personal social	70 $\pm$ 11	87 $\pm$ 11	< 0.001
General	71 $\pm$ 9	87 $\pm$ 9	< 0.001

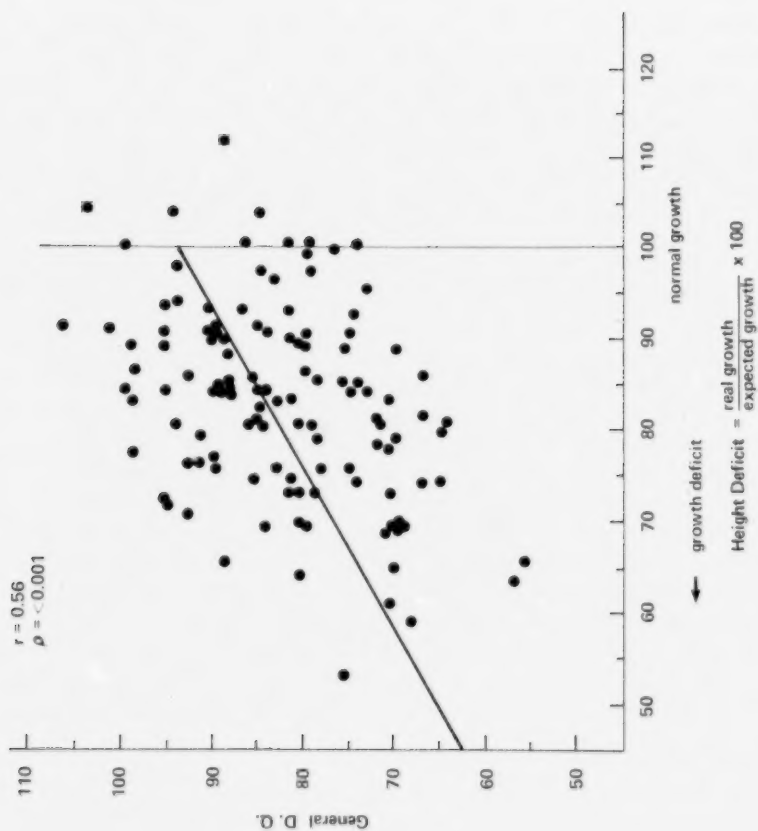


FIGURE 2. Height and mental development quotient in preschool children from 1 to 3 years old. A significant correlation can be observed between the percentage of deficit of growth and the general development quotient. The percentage of growth deficit was calculated by dividing the real growth by the expected growth for age in accordance with the 50th Iowa percentile and multiplying by 100.

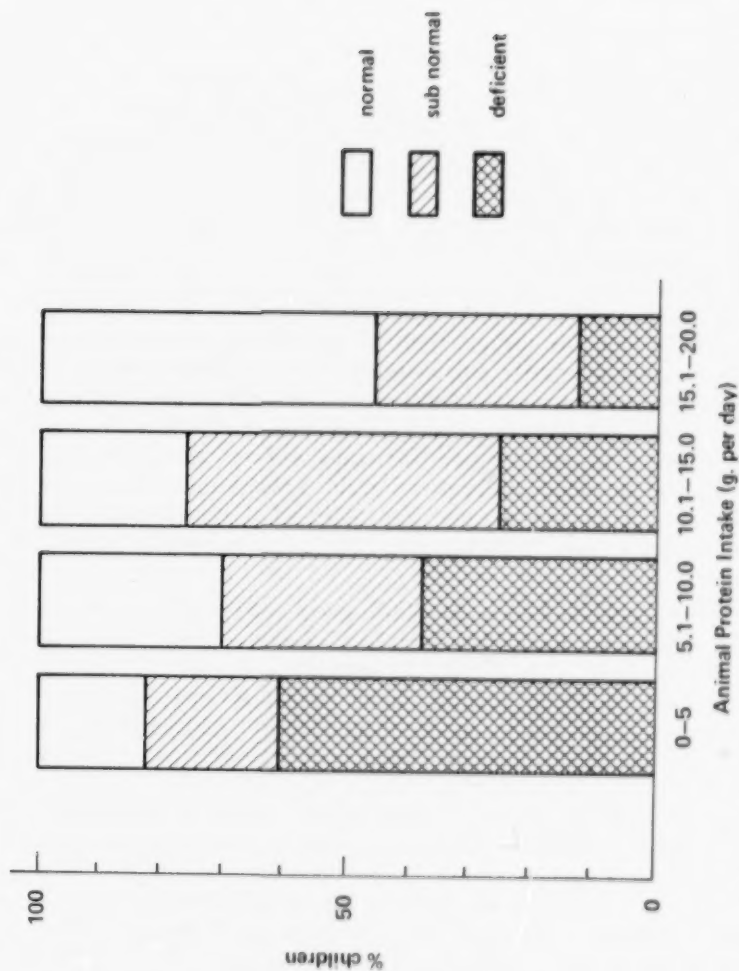


FIGURE 3. Percentage of mental normality and deficiency in preschool children with different animal protein intake (Gesell test). The animal calorie consumption was determined by a nutritional survey in every home, using the technique called "quantitative trend of food consumption," with chemical analysis of sample of food consumed during a seven day period.

can assume that children found to be nutritionally normal live in better cultural and educational conditions.

3. Part of the nutritional study involved a three-day observation of the food consumed by the children. It is possible to indicate total calories, total protein, and animal protein. There was no correlation between either total calories or total protein and intellectual quotient. But, as shown in figure 3, there was a correlation between the amount of animal protein consumed and intellectual development. The sample was divided into four groups according to the consumption of animal protein. The proportion of intellectually deficient children decreases in direct proportion to the intake of animal protein. These differences are statistically significant at the .001 level. It is interesting to observe, however, that there are almost no differences in the proportion of subnormal (as opposed to deficient) children in these groups. Thus, while animal protein consumption appears to reduce the degree of deficiency, subnormality may be related to environmental factors other than malnutrition. Although the population was apparently homogenous, it seems likely that there are economic and cultural differences between them. Animal protein is the most expensive part of the diet, and differences in consumption of animal protein indicates differences in income, and probably in other matters as well. This means that even though this correlation is very indicative of a relationship, we cannot conclude from it that malnutrition *per se* creates mental deficiency.

4. Our study confirmed the findings of others (Monckeberg, Donoso, Valiente, Maccioni, Merchak, Donoso, and Arteaga, 1967) which have shown that in preschool children of lower socioeconomic status a smaller head circumference is found, along with retardation in height and weight. Almost 30% of the children below 36 months of age had a head circumference below the 3rd Iowa percentile.

Figure 4 shows the correlation between head circumference and intelligence quotient. For this calculation the children were divided into two groups: those whose head circumferences were below the norm, and those whose head circumferences showed normal growth. For the group with retarded head circumference, there is a significant correlation between cranial size and intelligence quotient. For the group with normal head circumference, there is no such significant relationship.

These findings support the hypothesis that nutrition has an influence on intelligence, particularly since it is difficult to assume that retardation of cranial growth is the consequence of environmental factors other than nutrition. However, here again,

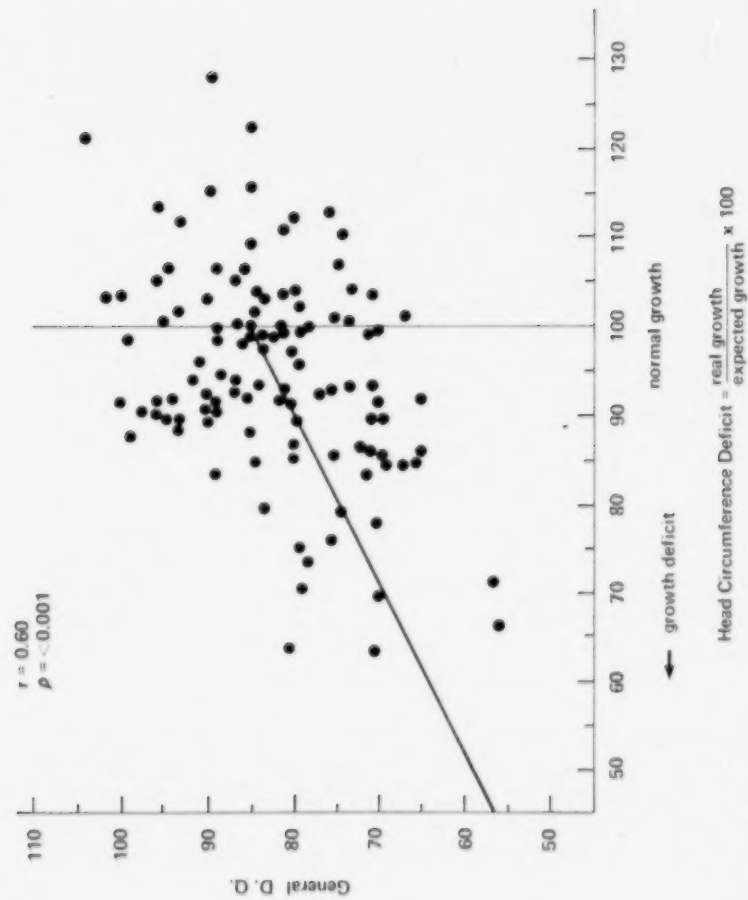


FIGURE 4. Head circumference and mental development quotient in preschool children from 1 to 3 years old. A significant correlation can be observed between the percentage of deficit of head circumference for age and the mental development quotient.

the evidence is not conclusive. While the studies do show a relationship between low intellectual performance and malnutrition in preschool children, they also show that the higher incidence of lower intellectual performance in these groups is influenced by many other factors peculiar to the 'underworld' of extreme poverty. Hence, malnutrition may be a concomitant or an etiological factor in this lowered intellectual performance. On the basis of our experience to date, it is difficult to determine the impact of malnutrition simply by looking at psychological test performance of undernourished children. It is necessary to search for other methods, particularly those that can determine the compromising effect of undernutrition on the development and function of the nervous system in isolation from other environmental factors.

Maternal Factors

Studying the relationship between mental performance and nutrition in preschool children presents only part of the problem. Maternal factors also have a role to play in the nutrition and development of the child. In our studies, we also gave the Wechsler scale to the mothers of the children. Previous findings (Krauskoff, Toro, and Monckeberg, 1966) of a higher frequency of poor performance were confirmed in this area, (table 2). The same test used in an earlier study of a group of 50 mothers from better socio-economic conditions gave normal values, similar to the norms for the test. But in the slum area, 17% of the mothers were subnormal, while only 4% of the mothers from better areas were subnormal. If mental deficiency is defined as scoring 79 or below, 77% of the slum mothers and none of the middle class mothers were found to be deficient. However, in these slum mothers, schooling correlates poorly ($r = .026$) with test performance.

In these lower socio-economic groups, it is usually the mother who has the main responsibility for the family group, and the primary responsibility for the children. Thus, it seems important to correlate the intellectual quotient of the mother with the child's nutritional status. These data are given in figure 5, which

TABLE 2
Intelligence Quotient of Mothers of Slum Area, and Middle Class

	Slum area (%)	Middle class (%)
Normal (over 91)	6	96
Subnormal (between 80-89)	17	4
Deficient (less than 79)	77	0

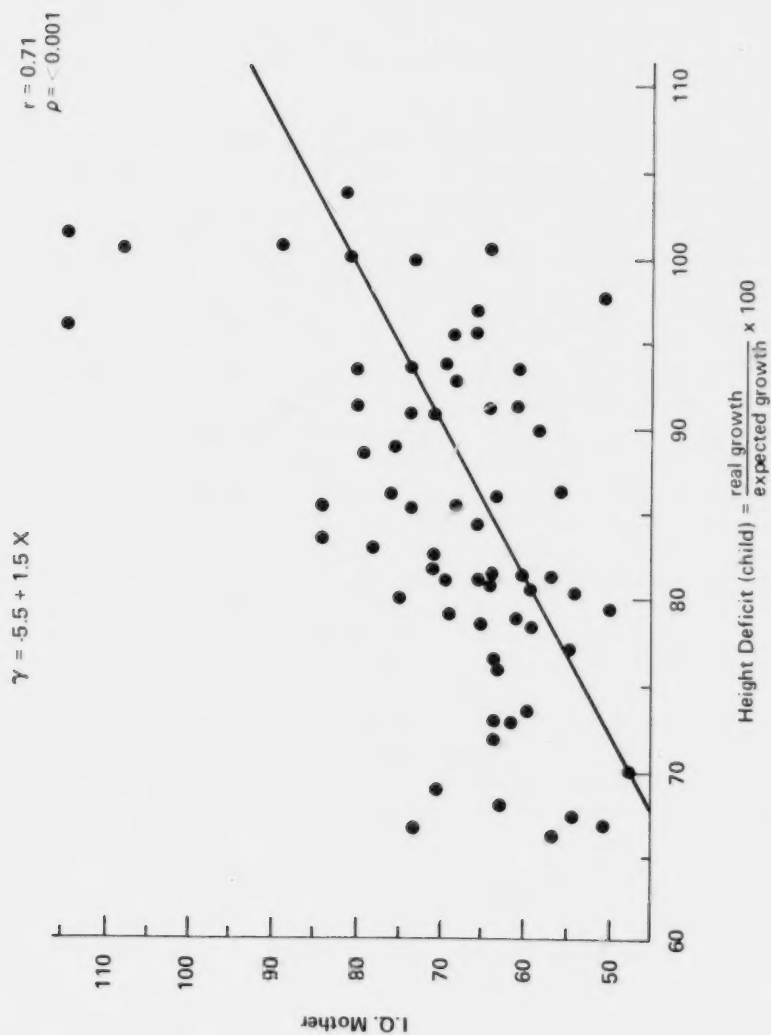


FIGURE 5. Correlation between intellectual quotient of the mothers and deficit of growth of the slum children between 1 to 3 years old.

shows a high correlation between mother's intelligence and the nutrition of the child ($r = 0.71$; $p .001$). This finding is extremely important. It means that malnutrition, and other social factors, not only produce a low intellectual performance, but also that mental deficiency aggravates malnutrition. This is a vicious circle which explains why malnutrition keeps on going from one generation to another, with little possibility for the individual to emerge from this condition.

There is sufficient experimental evidence, both in animals and in humans, to indicate that severe malnutrition affects the development and performance of the central nervous system. (Stewart and Platt, 1967; Dobbing and Path, 1968; Cravioto, De Licardie and Birch, 1966; Meneghello, 1969) This fact, together with the evidence presented here, suggests that there is probably also a proportional brain damage in the less severely malnourished. It is evident that culturally deprived groups of the lower socio-economic class present a high incidence of lowered mental performance. This is of great importance in underdeveloped countries. In many of these countries, 70% of the preschool children are underfed. The resulting limitation of mental capacity means, ultimately, that socio-economic development will be impossible. The lack of individuals who possess the skills indispensable for socioeconomic development is a characteristic of underdeveloped countries. In South America, only 20 out of every 100 who start primary school complete it (Power, 1966). In our judgment, and in keeping with work we now have in progress, this failure to complete school is due more to learning difficulties than to economic problems. This is a tremendous obstacle to rapid progress in these countries, since recent advances in technological progress demand that most individuals develop their total psychological capacities. It is true that malnutrition is the main cause of premature death, but the number of malnourished who survive is much greater, and therefore the total effect of malnutrition is simply disastrous. From our point of view, at this moment in time, it is only of academic importance to elucidate whether or not malnutrition effects the development of the central nervous system. Rather, it is of paramount importance to direct all our efforts to improving the nutritional and environmental conditions of the infant population, trying to break the vicious circle of: malnutrition—sub-cultural conditions—underdevelopment—and malnutrition again.

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BEHAVIORAL INTERVENTION STUDIES WITH MALNOURISHED CHILDREN: A REVIEW OF EXPERIENCES

by

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Leonardo Sinisterra*

For the past three years a research program concerned with the effects of multiple deprivations on the health and behavior of children has been conducted at the Human Ecology Research Station in Cali, Colombia. Special emphasis has been given to the effect of malnutrition on the behavioral development of preschool children from the lowest economic levels of that city. The initial focus was on the identification of specific aspects of psychological development which are negatively affected by poor health and nutrition, as well as other environmental deprivations. A wide variety of psychological measures were used with the goal of specifying those psychological characteristics most clearly retarded by chronic poor health and poor nutrition.

These early steps led to a concern with the development of two further areas which are critical for the development of applicable and relevant knowledge. The first area was the attempt to identify the types of interventions necessary to overcome the various damaging effects of early malnutrition, once the child has reached three years of age. It involved direct and sustained nutritional supplementation, behavioral stimulation, and medical treatment. The question was whether powerful behavioral stimulation and nutritional supplementation could overcome the retardation of these children. If it could be overcome, then at what age and for which psychological functions.

The second critical area was an investigation of the relationships of specific deficits (and their amelioration) to the real life, academic and social success of the children once they arrive at school. There is little value in focusing efforts on improving the skills of these children if these skills are not related to success in

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later life. For example, it makes little sense to improve eye-hand coordination if this is unrelated to success in school or other life areas.

We believe that children must develop a wide range of *socially effective behaviors*, by the time they have reached school age, if they are to become positive resources in their society and participate fully in culturally valued aspects of contemporary urban life. From this point of view, much research showing simple IQ changes, as a consequence of nutritional supplementation during the preschool years, may mean little if the components of IQ that change are of no importance in life. However, at this point we simply do not know the important, identifiable, and changeable components of psychological ability for young children. It may be that poor development of affective, attentional, social and other "non-cognitive" psychological characteristics is the most serious result of poor nutritional conditions. We have elsewhere labeled this area "general responsive capacity" (Bravo, McKay and McKay, 1970). In practical terms, our approach suggests more *behavioral measurement variety* is needed in studies of the effects of nutritional deficits and supplementation.

An approach utilizing an expanded range of behavioral descriptors relevant to an individual's preparation for productive social roles will provide a clearer description of the deficits produced by multiple deprivations. It will then enable us to specify more clearly how treatments may be employed to yield relevant developmental payoff for the children. This expansion and assessment of behavioral measures is certainly not an easy nor inexpensive task. It requires a wide variety of stimulus situations, more extended observations using more subject time, extensive observer training for interrater reliability, electronic and photographic equipment for recording responses, and a wider selection of subjects.

Thus, the three objectives may be summarized as : 1) identifying the *specific aspects* of psychological development *retarded* through nutritional, health, and other environmental deficits; 2) identifying *which* of the retardations *are modifiable* through various means; and 3) identifying the *relevance* of the modifiable and non-modifiable behavior *for future life*. Table 1 demonstrates the enormity of the measurement task.

Table 1 is a schematic representation of what we consider to be the possible outcomes of early childhood treatments of health, nutrition and behavior. These include criteria of school success as well as dependent variables measured during the treatment process. The school success criteria are perhaps the most stringent of all since they demand the persistence of treatment effects for relatively long periods of time. Measurement of all the anticipated

TABLE 1
Treatments and more immediate outcomes of behavioral and health interventions with
malnourished preschool age children

Treatments	Anticipated outcomes at end of intervention	Anticipated outcomes later in school years
A. Stimulation for behavioral competence	A. Cognitive growth	Greater ability to concentrate on school tasks
1. Reinforcement for general responsiveness and exploratory behavior	Higher cognitive test performance	Higher achievement levels in school work
2. Reinforcement for social interaction	More rapid relevant skill development (achievement test performance)	Reduced tendency to drop out
3. Reinforcement for verbal output	More productive attentional and seeking characteristics	Higher peer, parental and teacher esteem
4. Reinforcement for attempted solutions to problems	B. Social-affective development	Better control of social environment
5. Reinforcement for correct solutions to problems	Family and peer approval	Fewer days absent and in bad health
B. Health improvement	Growing sense of identity	More power and attractiveness physically
1. Nutritional normalization	Positive self esteem and awareness of competence	
2. Infection and disease prevention and control	Wide range of life interests	
3. Stimulation of motor activity	More effective social behavior	
	C. Biomedical status	
	Greater resistance to disease	
	Less preoccupation with bodily dysfunction	
	Age-appropriate physical growth and development	
	Greater general responsive capacity	

outcomes is still a goal for us, especially in the social-affective area, but our work is progressing toward operational definitions of all these variables.

The social-affective or social-emotional development of young children is particularly elusive from a measurement point of view. Ironically, it is these characteristics of malnourished children that are so obvious to those of us who work with them daily. We constantly observe characteristics such as apathy, sadness and fearfulness; these change dramatically with changed life circumstances, better diet and better health. It is difficult, however, to design a series of situation-specific observation scales that will move us from reliance on our 'gut feelings' or 'clinical observations' to a level where we can quantify the variables to show that what we observe is not just misperception from a desire to see such behavioral manifestations. We are only at the edge of this frontier area of measurement; a frontier not only in relationship to undernourished children, but in relationship to early childhood study *per se*.

Specific Variables Measured

At this point in our long-range research program, we have trained a group of behavioral observation specialists to gather reliable information using several different scales. Not all of these have been used in all studies, many are newly adopted, and several have been discarded when they failed to demonstrate reliability. Among those we have used and are presently using or developing for use are the following:

VERBAL COGNITIVE DEVELOPMENT

Picture Vocabulary—an important part of any intelligence test that measures the degree to which the child has become aware of his surroundings and has experienced the process of labeling his world.

Sentence Completion—a series of sentences in which a child is given a relationship between two words which he then must apply to another word pair. He is asked to infer the second part from the first.

Memory for Sentences—this is a straightforward immediate verbal memory task that is hypothesized to measure memory capacity and attentional characteristics.

Cognitive Maturity—adapted for local use from Bereiter and Engelmann (1966) which includes:

1. understanding singular and plural concepts in action

2. verbal descriptions of actions
3. memory for parts of sentences

Montreal Tests—a series of tests, developed by Pinard and adapted for Colombia by Dr. Francisco Cobos, based on developmental theories of Piaget. They include:

1. parts of speech
2. prepositions
3. judgment
4. counting

NON-VERBAL COGNITIVE DEVELOPMENT

Functioning Test—designed to assess the psychomotor and sensory capabilities of children from the age of three. The primary utility of this device has been to identify grossly retarded children during the process of medical screening.

Draw a Line Slowly—adapted for local use from a series of tests designed by Thomas Banta (1967). This yields an estimate of the degree of control a child has over his hand and arm movements, and perhaps his impulsivity.

Knox Cubes—adapted from Arthur (1930) for local use. This is a complex test which measures the ability of a child to follow an increasingly longer sequential pattern of events and to duplicate them a short time later.

Visual Haptic Cross-Modality Perception—adapted from a test designed by Birch and Lefford (1966) for use with preschool children. This measures the ability of the children to identify, visually, objects that are handled but not seen.

Montreal Tests—the same series as that described above, with these tasks requiring minimal verbal interaction.

1. construction
2. block arrangement
3. pegboard design
4. use of hands, use of fingers
5. tracing a form
6. bead classification

ACADEMIC ACHIEVEMENT MEASURES

Language Usage—a measure of the child's ability to use forms of speech which identify relations between objects.

Use of Letters—an elementary test of reading skill, beginning with simple letter identification and naming.

Use of Numbers—an elementary test of arithmetic skill, beginning with simple number identification, naming, counting.

Color Discrimination—a test designed to measure the development of color concepts.

AFFECTIVE-SOCIAL DEVELOPMENT

Adjective Rating Scale—a series of rating scales in a semantic differential format, using a standard situation over an hour time sample. The next steps for this scale will include more situation specificity and redefinition of the variables. One aspect of the "situation" to be studied is observation *in the home* versus *in the institution*.

1. brusque	—	smooth
2. happy	—	sad
3. obedient	—	disobedient
4. insecure	—	secure
5. sociable	—	isolated
6. interested	—	disinterested
7. extrovertive	—	introvertive
8. competitive	—	cooperative
9. active	—	passive

Bayley Observation Scales—adapted from the infant scale of Bayley (1968) for use with local children aged three or above. These are rating scales for which situation specificity is still needed. Some of these overlap with the *Adjective Rating Scale* for reliability testing.

1. social orientation
2. cooperativeness
3. fearfulness
4. general emotional tone
5. attention span
6. endurance
7. general activity
8. excitability

Familiarization with New Setting and New Social Contacts—this was designed to assess the child's socialization in situations where he is faced with "strange" circumstances, encountered outside his home.

1. time to establish a relationship
2. verbal fluency
3. transient behavior
4. interaction in games
5. use of toys
6. emotional behavior
7. motor behavior

These tests are continually refined and new ones added as we analyze more data. It is a somewhat fluid system which is methodologically permissible in our present design, and a system from which we expect to develop succeeding more valuable insights.

A little further on in this paper, you will learn of the way in which we used these tests and scales, and a little of what the evidence is telling us. Let me summarize by restating our present belief. The measures of human development used in this research area need to be expanded to include reliable assessment of social-affective responses, as well as more clearly articulated cognitive and intellectual skill development. Furthermore, we stress the need to emphasize the relevance of the variable studied to real life success or failure for children, in terms of the child as a human resource and as a satisfaction-seeking organism.

General Methodological Issues in Intervention Research

As stated earlier, we have come to the conclusion that the best opportunities for us to study the very complex interrelationships among health, nutritional and family factors in psychological development of young children lie in adopting an intervention model as the primary research mechanism. Specifically, we use a *nutritional and behavioral* intervention model.

It is clear from our own cross sectional research (McKay, McKay, and Sinisterra, 1969; McKay, 1968), as well as that of many others that children suffering from undernutrition are retarded in many aspects of psychological development. The usual use of a correlation research model to elaborate this retardation is methodologically too inexact to give definitive guides to appropriate remedial techniques. Studies designed to assess differences between groups for whom history is uncontrolled suffer the clear handicap of never achieving definitive exclusion of possible causal factors, other than the one chosen for study (Campbell and Stanley, 1963). This is even more of a handicap in dealing with a variable as causally complex as retarded human psychological development. Even the statistical partialling out of all available explanations does not provide certainty that there might not be others.

The best that can be done with such studies is to use the data either as guides to more definitive experimental studies or to eliminate from further consideration those variables found unrelated to retarded development.

We have found that relationship between nutritional status and various aspects of psychological development to hold up under partialling, but as indicated above, we could not be sure of the positive effects of treatment simply by *ex post facto* inference. Thus we conducted studies to assess direct treatment effects through an intervention model.

We view the goal as one of improvement of human potential and believe that our work must proceed directly toward that goal. In this way we will be gathering data which will provide closer and closer approximation to definitive answers to the questions posed in our three research components.

Before describing samples of these studies, we would like to outline some of the preliminary steps leading up to them. It is our contention that great care must be exercised in the preliminary steps to avoid a spiralling of errors in selection and design that could permanently invalidate results of large scale longitudinal studies which involve considerable investment.

In nearly all cases, we have begun by identifying areas of the city that we estimate, from our own observations and those of other medical and social workers, to be composed primarily of very low income families. A preliminary survey is made of the area to obtain a count of all children living there who are within the birthdates specified by our experimental design, and to verify that living conditions indicate a very low economic level.

Following this, we bring in, for preliminary health screening, all of the available children of the appropriate ages who live in a sector containing approximately double the number of children demanded by the design. This provides us with subjects who live relatively close to one another, thus reducing the logistical problems. This also provides an accurate picture of the community's needs for health services for interested agencies and research groups.

Next, community workers gather socioeconomic data using a brief questionnaire to be used in the selection process. This includes recording the names, age, educational history, and income of all family members in the household. In addition, more quantified data about living conditions are gathered.

With this medical and economic data, we are in a position to select a "pool" of children at the lowest levels to be assigned to the particular groups indicated by the needs of the study. This is done in a fashion to equalize the groups on the selection criteria.

This assignment to groups is usually random although great inequalities in means on the selection criteria are sometimes adjusted by a random shifting of individuals.

When a normal control group from the same neighborhood is utilized, we select children approximately at the median of U.S. norms on height and weight for age, with global medical evaluations of good health and few, or insignificant, clinical signs. Generally, this is a small group comprising the top 20% and has averaged about double the per capita income of the lower group. Behavioral and biochemical measures are not applied until just before treatments begin, thus eliminating the need to commit resources to the measurement of individuals who will not appear in any analysis. This general preparatory methodology yields groups, in the experiments, that are 1) practically equivalent to each other, and 2) represent the larger community in an unbiased way.

We have found the selected children come from families in which the average income per person per month is about five dollars, with no additional sources of food and other goods. They have a mean weight and length below the 3rd percentile on the Boston norms, an average of more than ten clinical signs (from Jelliffe) of malnutrition, and five to six dental caries. There is tuberculosis exposure in 10%, histories of chronic diarrhea and vomiting in over 50%, nearly 75% have an abnormally high parasite count, and 15% have extensive skin infections. All have global medical evaluations of poor health.

Specific Intervention Studies: Designs and Sample Results

In all of our intervention studies up to and including the present four year longitudinal one, we have used the same basic experimental design with the following types of major treatments:

Type A.	behavior stimulation
	Test —————> plus —————> retest
	nutritional and health care
Type B.	Test —————> nutritional and health care —————> retest
Type C.	Test —————> no treatment —————> retest

This paradigm is missing a group which would have made a neat two-by-two factorial design; that is, a group receiving behavior stimulation but no nutritional and health care. Up to this point, such a group has been unfeasible because the treatment provided to the Type A groups has been an all day affair, which, in order to have equivalent conditions between treatment groups,

would have required providing stimulation and only small amounts of food daily. For children who are receiving extremely small amounts of food at home, and who are losing ground nutritionally every month, such treatment would contribute to their increasingly hazardous undernutrition. Our future projections do not include such controls. The studies contemplated will assess the relative benefits of behavioral intervention plus nutritional treatment compared to those gained from nutritional treatment alone.

Within each of the major types of treatment variables, we have further subdivided each study in different ways. This design yields the possibility of using analyses of variance, and provides a wealth of information regarding interactions among the major treatments and the minor variations within them.

First Pilot Study

Our first major short-term multifactorial experiment included the following groups:

Type A.	CS	Cognitive stimulation plus nutritional and health care
	PS	Physical stimulation plus nutritional and health care
Type B.	LS	Low stimulation, free play plus nutritional and health care
Type C.	CO	Control, no treatment, siblings of treated children

In this study, all children were from low income families and presented a clinical and anthropometric picture of having endured chronic undernutrition. All four groups were equal in mean age and nutritional status indicators.

The nutritional and health care program was designed to produce significantly higher than normal physical growth rates, and this was achieved. The evidence was satisfactory to the medical team that the children in groups CS, LS, and PS had all achieved nutritional normality and were beginning to catch up to the normal levels in growth. All three groups had equal rates of recuperation.

We will not dwell upon the behavioral treatments here except to say that the cognitive stimulation group received a four-month program of highly concentrated verbal activity, and experience in object and concept classification and generalization, while the physical stimulation group was simply kept at a high peak of motor activity daily for the same four-month period. The

low stimulation group was kept in the health center with a caretaker and several types of toys and games to play, but was not directed to behave in any special way except for feeding and hygiene.

Figures 1-3 are samples of data selected to illustrate general trends and some specific puzzling relationships. The selection of only significant results from a large number of comparisons in which there are only a few significant ones is sure to yield misinterpretations. The samples presented here, although not randomly chosen, were selected to fairly reflect the general trends found in other variables.

The three variables presented here are two measures of cognitive development (Knox Cubes, Sentence Completion) and one

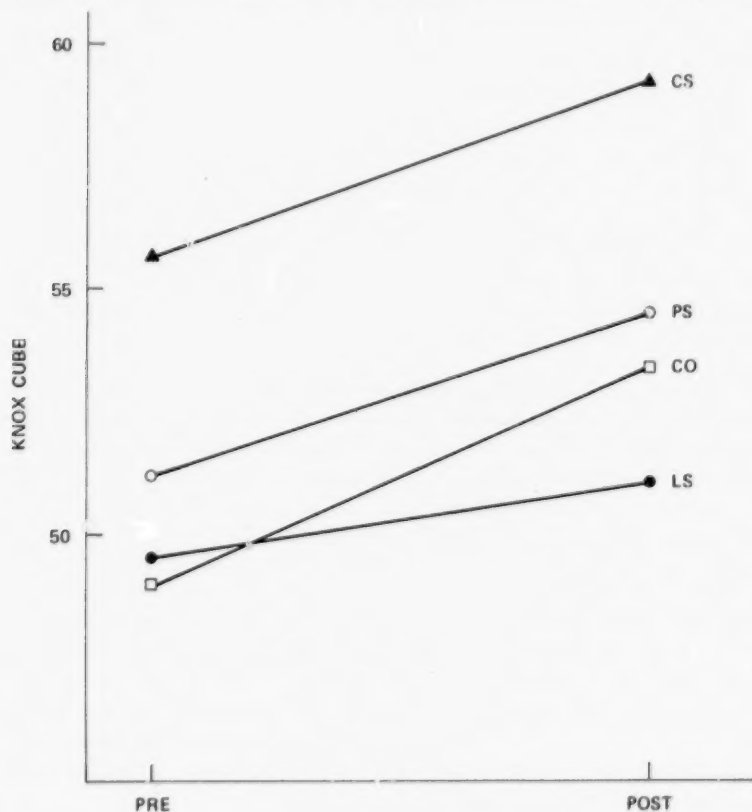


FIGURE 1. Knox Cubes test score changes over four-month period of first pilot study. Test scores are standard scores (Mean = 50, SD = 10) based on norms for children from subject *barrio*. See text for identification of treatment groups.

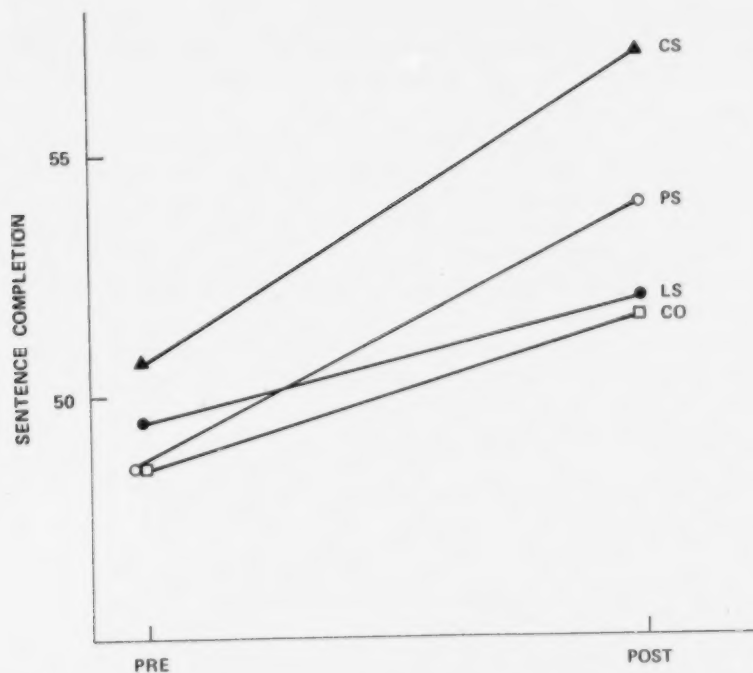


FIGURE 2. Sentence completion test score changes over four-month period of first pilot study. Test scores are standard scores.

of "relevant" skill (Use of Letters). In all three cases, we see the LS group (improved nutritional and health status only) developing, in the four-month period, at a rate no better than untreated controls. This we also found in the second pilot study.

Among all the measures used in the study, none showed the LS group improving as a result of receiving a good diet for four months, even though they increased more rapidly than normal in measures of health and nutritional status. This was the case regardless of the level of initial malnutrition, even though the more undernourished children began the program below the slightly better nourished children in nearly all measures.

We did find that initial levels of performance could be changed upward with nutritional supplementation and behavioral stimulation, in some developmental aspects in four months. This is shown in figures 1, 2 and 3.

The performance on Knox Cubes seemed resistant to treatment with the method employed in this study, as can be seen in figure 1. The change from pretest to retest was statistically the same for each group—treated groups responded no better than

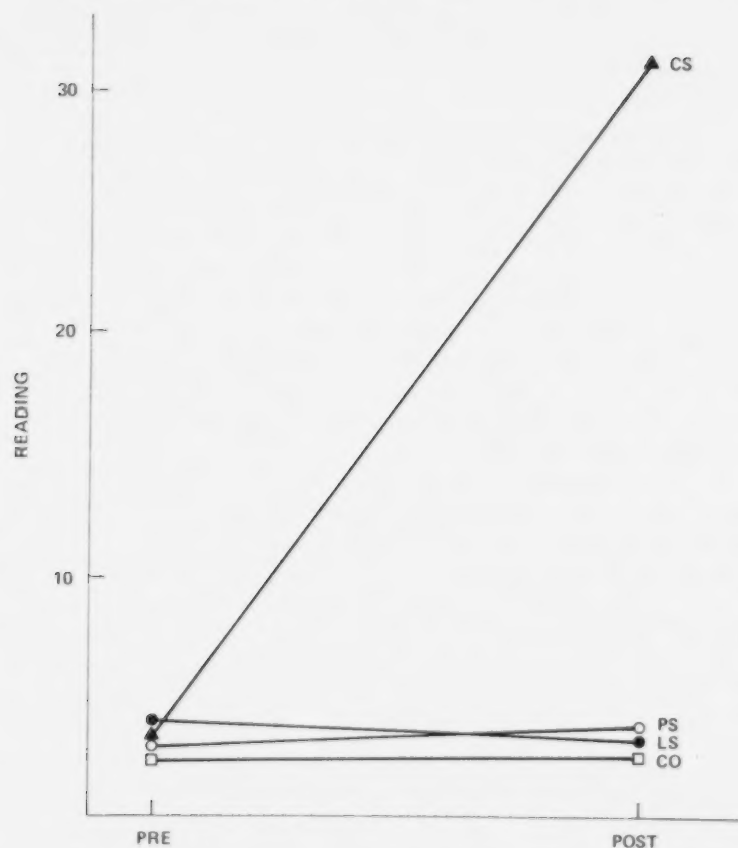


FIGURE 3. Use of letters (reading) test score changes over four-month period of first pilot study. Test scores are raw scores.

controls. This result (coupled with the data from the Memory for Sentences test not shown here) suggested to us that the undernourished child's retardation of short-term memory is especially resistant to treatment; behavioral and/or nutritional. In a verbal task requiring the creation of conceptual relationships, the Sentence Completion (figure 2), the behaviorally treated (CS, PS groups) began to separate from controls and ended up significantly higher than the other groups.

Also, in this measure, the highly verbal treatment of the CS group did not yield gains superior to the highly physically active PS group. The same results were found among all "basic" cognitive measures. These results suggested that the different types of behavioral treatments we were providing yielded equal experience

in readiness to learn verbal relationships, and this was higher than non-behaviorally treated children.

The third figure shows differences between the two behaviorally treated groups in learning specific intellectual tasks. It is clear that with this skill being directly taught to the children, the CS treatment had a very different impact on this specific skill development than the PS treatment. It was hypothesized that the CS treatment (high intensity reinforced repetitive verbal response) would generalize to affect performance on more "basic" cognitive and relational tasks. It did on some verbal relational measures, but to no greater an extent than that achieved by a series of high physical activity games. Conversely, however, it was shown that a program of intensive cognitive stimulation is not less effective than high physical activity on any measure, including physiological development.

Behavioral stimulation worked to a moderate degree to improve some basic intellectual capabilities, and dramatically in specific task achievement. However, the goal was far from realized, as some of the measures showed no change with treatment.

Second Pilot Study

In the next study, the behavioral treatment was the same for all children brought to the Center, this time for five months. The sequence of stimulation was better established, the teachers more experienced, and the activities more varied. This time two secondary variables were more systematically considered; nutritional level at the start of the program, and "spillover" effects to undernourished siblings of the treated children.

For the second study, we included a group of nutritionally normal children from the same poor neighborhoods and mixed them with the malnourished only in the cognitive stimulation program. In order to avoid what might have been negative effects suffered by the LS children in the first study, we decided to treat the group receiving only food and health care by delivering the food to them in the home and bringing them to the center only for regular health visits, rather than keeping them all day in the center. There were three types of non-treated controls: a group of nutritionally normal children, a group of malnourished children who were siblings of those in the program, and a group of malnourished children who were unrelated to the children in the program.

Using the same outline of treatment as above, the treatments can be seen in the following:

Type A.	CSU	Cognitive stimulation, food and health care, malnourished children
	CSN	Cognitive stimulation, food and health care, "normal" children from same neighborhood
Type B.	LS	Food and health care only, malnourished children
Type C.	CO	Nontreated controls, malnourished children unrelated to program children
	COS	Nontreated controls, malnourished siblings of program children
	CON	Nontreated controls, "normal" children from same neighborhood

The first study led to questions related to our concern for the relevance of the treatment and our measures. The stimulated and fed undernourished children made gains over the controls. To what extent did this bring them close to what could be considered adequate levels of functioning for their ages? If the central purposes of the treatment are to achieve practically significant payoff from the treatment, then gain over non-treated controls is a significant, but unsatisfactory, finding. The treated children eventually did better on the cognitive tests than the mean of their non-treated, malnourished peers from the same community. Is this adequate? What would non-malnourished poor children do in the same circumstances?

Figures 4, 5, and 6 show the results of this study using the same three variables presented for the first study. In addition, Figures 7 and 8 show examples of our very preliminary attempts at measuring affective-social variables.

Figures 4, 5, and 6, show that the "food only" group did not do better than controls. Also there appear to be no "spillover" or "diffusion" effects from the program to the home.

Major results are related to the differences between normally nourished treatment children and malnourished treatment children on the Sentence Completion task (and other verbal cognitive tasks not shown here). At the start of the program the normally nourished (CSN) were superior to malnourished (CSU), which was in accord with expectations. Also, with the same treatment they *maintain their superior position*. In the five-month period of this study, however, the malnourished children were able to surpass the level of normally nourished, poor children (CON) who received no treatment.

In non-verbal cognitive development, represented by the Knox Cubes data, something of the same relationship exists. The

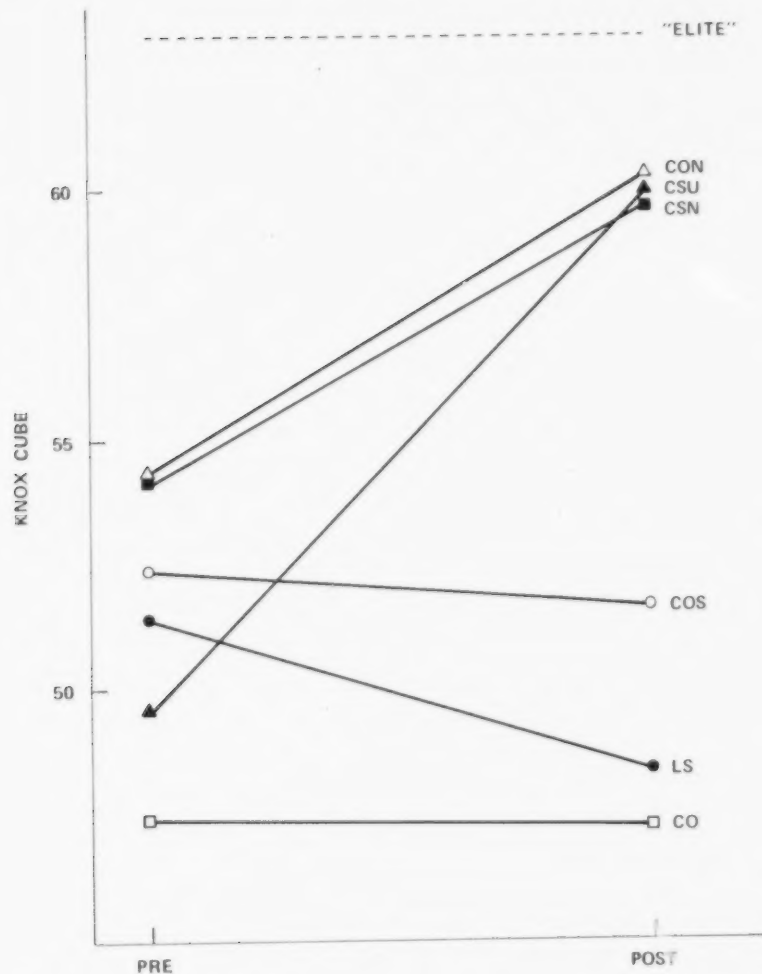


FIGURE 4. Knox Cubes test score changes over five-month period of second pilot study. Test scores are standard scores. See text for identification of treatment groups.

CSN group starts out higher but the CSU group catches up; however, not surpassing the CON group. Taking all non-verbal tests together, the CSU children make gains on both CSN and CON.

These interactions suggest that some abilities are depressed by nutritional deficit, and may be fully recuperable with treatment, while others may only directly reflect experiences. That is, retardation of those capabilities demanded by the non-verbal

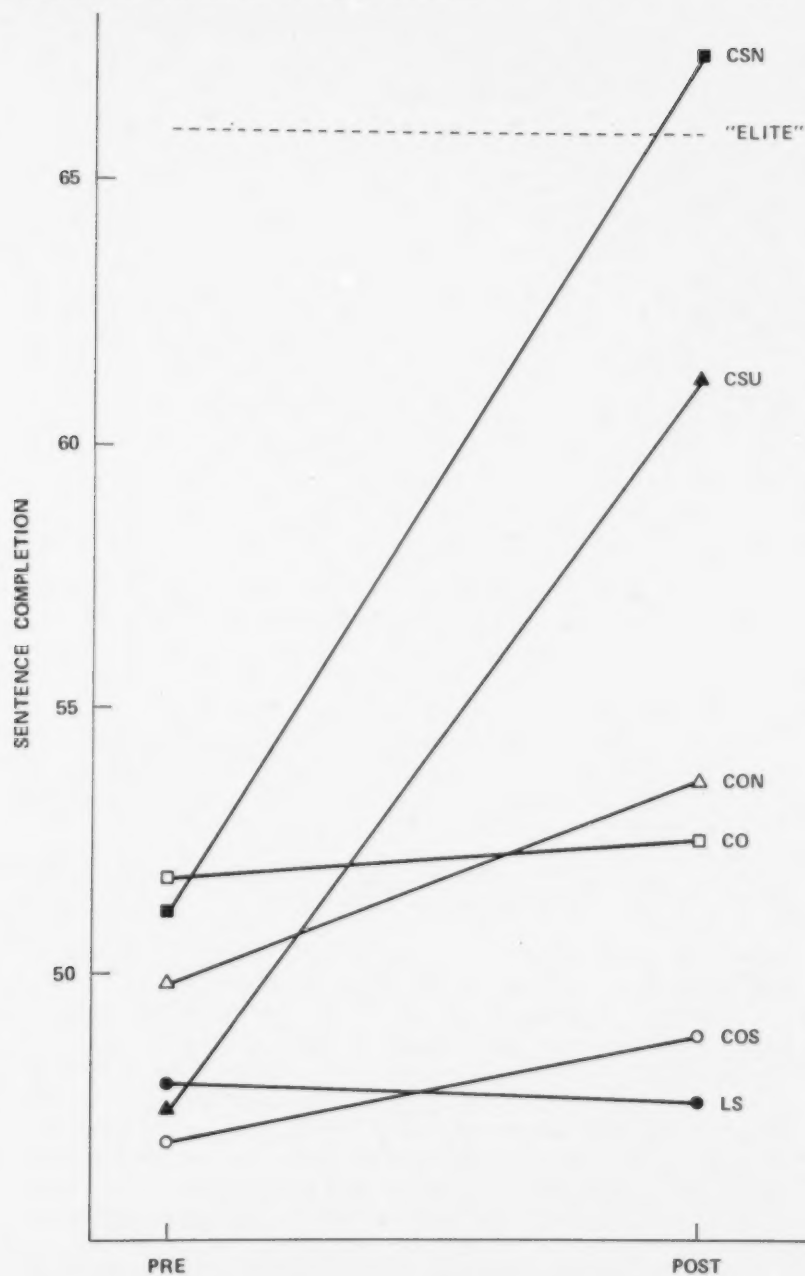


FIGURE 5. Sentence completion test score changes over five-month period of second pilot study. Test scores are standard scores.

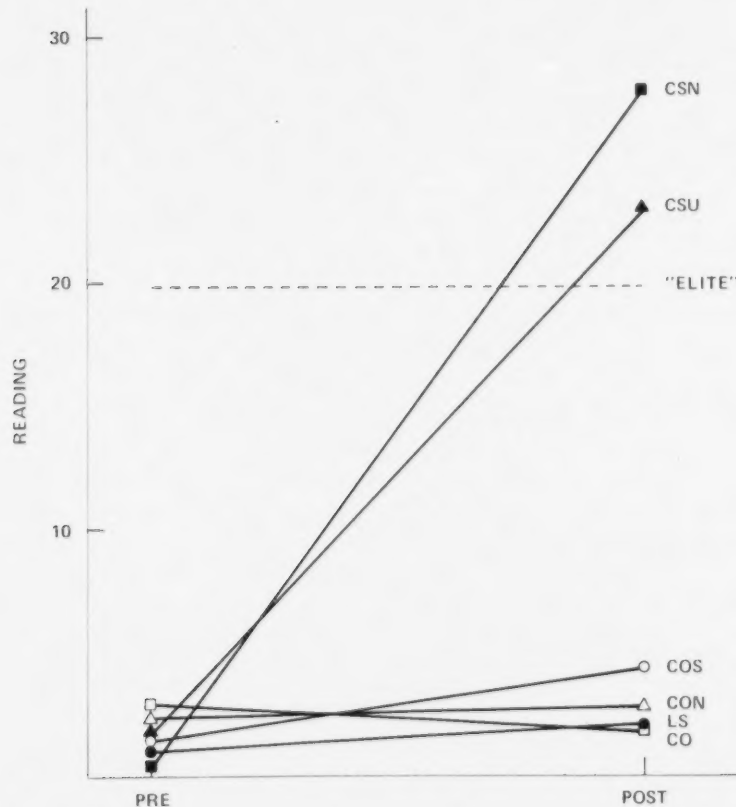


FIGURE 6. Use of Letters (reading) test score changes over five-month period of second pilot study. Test scores are raw scores.

tasks may be overcome, but the amount of information processed will continue to reflect differential experiential history.

Although it appears that some of the deficits can be made up with intensive behavioral stimulation, there is another aspect to be considered. In figures 4, 5, and 6, the broken lines ("Elite") above the graphs for treated children represent the levels on the tests reached by a sample of children from some of the most advantaged families of the city. Actually, they are somewhat higher for the verbal test, but the scale adopted for this figure (the same scale as in figures 1-3 from the first study) does not permit exact placement.

The malnourished children were able to catch up to their neighborhood peers who were not malnourished, but they were still behind the "standard" of well nourished, economically well-

to-do children. The differences would be even greater if the testing of the elite children had been better, and if the test-retest increments had been available. These children were only tested once under quite unfavorable circumstances. Interestingly, these results are closely paralleled in a study with rats by Harada and Tanabe (1970), in which they showed that malnourished animals with enriched environments surpassed unenriched normal rats on Hebb-Williams problems, but remained significantly behind environmentally enriched normal rats.

This is not to say, of course, that with longer treatment or more well-constructed treatments, malnourished children could not be brought to the levels of even the "elite." It appears that the malnourished preschooler already has suffered a degree of loss that makes it more costly to recuperate him. The study in Bogota in which children will be nutritionally treated from a very young age, will show more clearly how in early life the negative effects of malnutrition can be vitiated.

As can be seen, the nutritional factor is not nearly so critical in the achievement test data (use of letters labeled "READING" in figures 3 and 6). Malnourished and normal children alike can quite readily be brought to levels of competence surpassing the elite groups (although the education received is nonetheless complex). What remains unclear, however, is whether this sort of easily achieved intellectual skill development, accelerated this early, has any later real life consequences that give the malnourished child any "edge" on the "standard" groups.

Figures 7 and 8 represent some of the tentative findings in the affective-social development of the children.

In these figures, only extreme differences yield statistical significance, and, thus, we use the term "tentative" (for further exploration). Our present study will yield more definitive results, but we think it to be of some value to present at least some relationships that reflect trends.

First, these graphs show the irony expressed earlier; that what we consider to be obvious is very difficult to demonstrate when quantification is applied. We suspect that there is a considerable component of optimism in our anecdotal accounts of affective changes that does not stand up under closer scrutiny.

Figures 7 and 8 are graphic representations of the pretest-retest changes over five months on two of the measures of affective-social behavior. These are the Security-Insecurity dimension (figure 7) and the Active-Passive dimension (figure 8). For these figures, the two malnourished control groups (siblings and non-siblings) have been combined to yield one control group. This was done after it became clear there were no "diffusion" effects—that

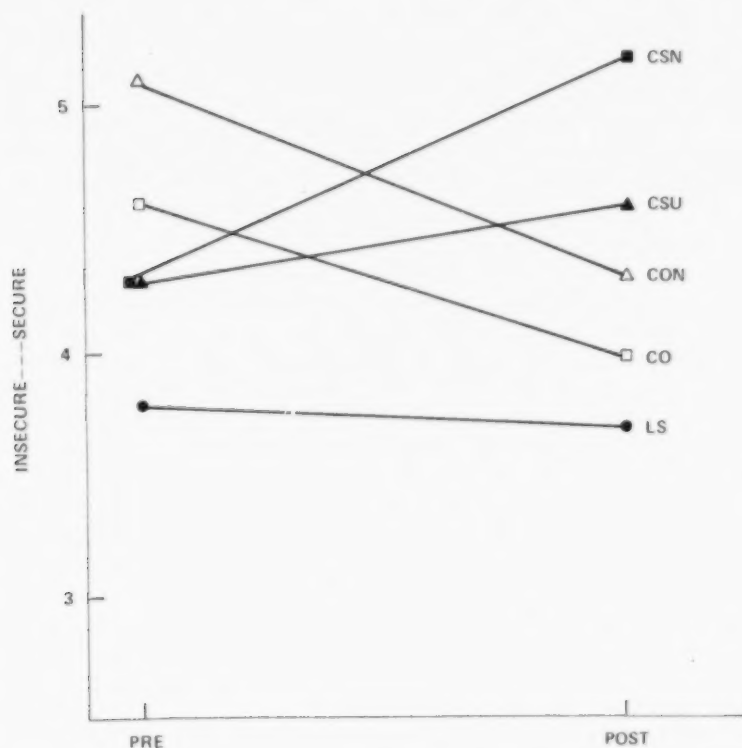


FIGURE 7. Changes in rated insecurity of children over five-month period of second pilot study. Score units are group mean ratings on seven point rating scale. See text for identification of treatment groups.

is, that siblings of treatment children behaved no differently than non-related malnourished controls.

It is relevant to describe some of the methodology of assignment of subjects to observers, since observation of affective and social behavior is notoriously subject to observer biases; much more so than with cognitive behavior assessment. Where, in a cognitive test, the observer simply records several on-off behaviors one at a time—whether or not a child says the correct word, taps the correct block, or constructs the correct tower—the recording of affective response requires the observer to sum over a number of on-off behaviors. In the case of security-insecurity, these include facial expression, approach versus avoidance responses, and vacillation versus consistency of response tendency. The final goal is to specify these separate responses. In the beginning stages of the development of measures of more complex so-

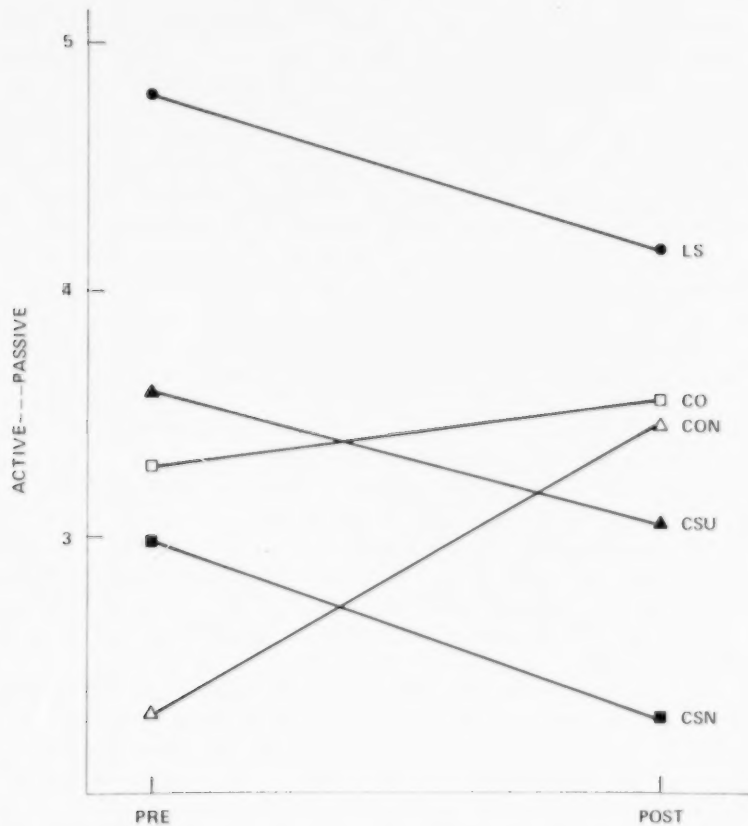


FIGURE 8. Changes in rated activity of children over five-month period of second pilot study. Score units are group mean ratings.

cial and emotional phenomena, the rapid fluctuation and multiplicity of children's responses, even in short time periods, contribute to the observer's unreliability by making him select, from short-term memory, one tendency from a relatively large number that have occurred.

To control for prior biases which may condition what the observer selects from the response array, children are assigned to observers randomly. The probability that the observer will see the same child twice is about one in 36. Further, the children in the various experimental groups were mixed in the order they appeared for testing, so the observer had minimal cues as to the history of each child.

These are rather gross, though necessary procedures. The

most adequate way of dealing with assessment in this area is to make observation as situation specific as possible, though free enough to permit sufficient emotional or social behavior variation and to specify more precisely the range of behavior to be recorded. This requires considerable observer training.

In all of the adjective rating scales displayed in this second pilot study, the two behavioral treatment groups differed from the completely untreated controls in that the changes from time one to time two (five months apart) were in the *opposite direction uniformly*. Thus, at least with the CO and CON groups versus the CSU and CSN groups, figures 7 and 8 are completely representative.

However, variation was found in the direction of LS, the food only group. In some cases this group changed in the direction of the other treated groups, in some cases in the direction of the untreated controls, and in some cases intermediate between the treated and the untreated. This could be viewed as random fluctuation except that it occurred within a framework of a completely uniform relationship of treated to untreated.

In the examples chosen, we see two of the patterns. In the security-insecurity dimension, the food only group maintained its pretest rating while untreated controls moved toward the insecurity pole, and the treated groups (CSN, at least) moved toward higher security.

In the active-passive dimension (figure 8), the LS group moved in the same direction (toward more active) as the CSU and CSN treated groups, while untreated controls (CO, CON) moved in the opposite direction (toward more passive) in the five-month period.

Although tentative, these data suggest that changes in the affective-social realm could be the most fundamental ones resulting from nutritional recuperation without behavioral intervention starting after the age of three. It would appear to be a reasonable assumption that increasing the physiological potency of the child, and removing distracting aversive sensory stimulation resulting from infection and disease, lays down a basis of directed responsive capacity which is more favorable to the child's receptivity for learning. The analysis of differential responses of various treatment groups on such aspects of development is one of the most potentially fruitful directions of our research.

In our present longitudinal study malnourished children are entering treatment at the age of three and continuing for three years until they start school. With this study we will be able to assess the impact of extended nutritional recuperation. Central to the project purposes is the degree to which malnourished children, from depressed urban environments, can be stimulated to

achieve, or surpass, levels of culturally relevant and valued behavioral capabilities possessed by the most advantaged segment of the population of preschool children. The design, identical in basic structure to that of the previous pilot studies, is as follows:

Type A.	CS1	One year cognitive stimulation, nutritional and health care; malnourished children
	CS2	Two years cognitive stimulation, nutritional and health care; malnourished children
	CS3	Three years cognitive stimulation, nutritional and health care; malnourished children
Type B.	LS1	One year nutrition and health care; malnourished
	LS2	Two years nutrition and health care; malnourished
	LS3	Three years nutrition and health care; malnourished
Type C.	CO	Malnourished control
	CON	Normally nourished control from same <i>barrio</i>
	COE	Normally nourished control from highest income levels

Conclusions

Two major conclusions and several fundamental questions emerge. The first conclusion is that many psychological characteristics and capabilities are retarded in the first years of life of children who also have chronic nutritional and other health deficits. The second is that carefully designed experiments show that some retarded developmental characteristics are remediable through treatment beginning in the preschool years.

Fundamental questions still unanswered satisfactorily are:

1. What are the specific aspects of development affected by the deficits, and to what degree are they differentially affected? Especially lacking are indications of what emotional, attentional, and social behaviors are negatively affected.
2. How relevant are these specific aspects to the future functioning of children in school and other significant environments, in terms of the children's potentiality for productive and satisfying social roles?
3. Which of the relevant behavioral capabilities and characteristics are remediable in the preschool years?

4. With what combinations of nutritional, health, and behavioral treatments can the specific and relevant characteristics be modified positively?

5. At what age must treatment start and how long must it continue to provide maximum remediation for the least favored children in society?

The questions are difficult to answer, but are critical for a more definitive understanding of the relationship of a variety of health and nutritional variables to early psychological development. This understanding would lead to more confident and precise recommendations for large scale social action with specifiable results.

We believe that the point has now been reached in human behavior-nutrition research where the amount of socially relevant and theoretically rich information can be increased dramatically. It is our hope that more interdisciplinary teams of skilled researchers may be attracted to and supported in basic studies in this area.

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NOTE: The research programs reported here have been conducted under the auspices of the Division of Health of the Universidad del Valle and the Council for Intersocietal Studies of Northwestern University. Financial support for these programs have come from a grant from the Ford Foundation, as well as the two sponsoring institutions. In addition to the authors of this paper, associate investigators at the Field Station are Libardo Bravo, M.D., and Francisco Linares, M.D., Universidad del Valle, Guatemala, C. A.

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DISCUSSANT'S COMMENTS

by

Julio Meneghello R.*

For many years I have been involved in studies focused upon clinical, biochemical, and public health aspects of child development, based on the principle that nutritional problems are only some of the most important health hazards of childhood. With this concept in mind, the enormous publicity given to the relationship between malnutrition and mental retardation in the last few years is especially disturbing. There are dangerous consequences in considering these relationships as one of cause and effect, to the exclusion of other factors.

In 1965, the Pan American Health Organization and the National Institute of Child Health and Human Development, sponsored a conference on malnutrition and mental development. Several specialists discussed the problems arising from some research projects that were being carried out in Latin America. At that time there was agreement on the need to define accurately: the type of malnutrition, the strategy and problems of research, including the children to be studied; the importance of malnutritional factors; the length of the studies; the development of research designs to answer specific questions; and the problems of data analysis and interpretation of results.

As a general pediatrician interested in nutrition, I would like to comment on five general areas: the prenatal and perinatal conditions that may be involved in the production of mental retardation in infancy; the psychosocial conditions as factors in low intellectual performance; the lack of homogeneity of the selected group under study; the measurement of intellectual functions, characteristics of growth and development; and the developmental disorders of motility and language.

In relation to the first area, there are a group of biological conditions, which are difficult to evaluate and measure, which may influence the nutritional status and/or mental development and, therefore, mislead in the interpretation of data. Particular em-

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phasis should be given to the prenatal and natal conditions. However, an enumeration of these does not imply that any single factor could act as a simple force upon a passive fetus. To the contrary, interaction is at all times the relevant phenomenon.

Other conditions act on the fetus during labor or immediately afterwards. Both viral and bacteriological infections can occur during pregnancy, and have deleterious effects for the fetus or the newborn. Further, maternal infection or medication may also interfere with the normal development of the infant.

When analyzing the cause of neonatal death in Chile, we find that 16% are due to anoxic and hypoxic disorders, 11% to prematurity, and 7.8% to abnormal labor and lesions at the time of birth. This means that 35% of the neonatal deaths correspond to conditions that might determine higher risk of malnutrition and eventually neuromotor and mental damage.

In addition, in animal experiments on maternal malnutrition, when hypoxia is added as a variable, we learn that hypoxic rats and mice, compared to undernourished ones, show more severe damage, expressed by decreases in brain weight and in cell serum. By extrapolating the animal experiments to human, it is reasonable to assume that chronic hypoxia could be more devastating than undernutrition in the newborn human.

Over the last few years, a new field in Obstetrics-Pediatrics has been developed. This could be called "Fetology." Methods of measuring fetal hypoxia and placental function have been developed and more precise definitions of what obstetricians mean by terms such as prolonged labor and fetal distress have been discussed. To what extent have these conditions been considered in the preceding studies? It may very well be that due to measurement difficulties, they were not included. However, when designing a study, one should endeavor to obtain homogeneity of the sample in regard to these variables.

The second point is psychosocial conditions as factors causing low intellectual performance. This involves the importance of the psychosocial conditions, including the unwanted child, child-rearing practices, variety and intensity of environmental stimulation, social pathology of the family, and adequate emotional interaction of the mother and child. These factors have been demonstrated to be inadequate in the underprivileged groups of Latin America where malnutrition and low intellectual performance are prevalent.

Another characteristic of these studies is the lack of homogeneity, since they have been carried out in: (1) highly selective groups—hospitalized children in urban areas; undernourished children from rural areas; preschool and school children of low socio-economic groups;

(2) without comparable characteristics, such as the age of the onset of malnutrition, the duration and severity of malnutrition, and with the use of different therapeutic measures;

(3) different methods of evaluation, including the use of different growth curves, different psychological tests, and variable follow-up and numbers of controls. All these factors make impossible the comparison and generalizability of results the validity which extends only for the experimental groups.

I would like to emphasize some aspects of the measurement of intellectual function and psychological test validity. We must remember that growth and development are dynamic processes so that the finding of a delay at a given age does not necessarily mean physical or mental retardation. The lack of continuous progression is not necessarily abnormal, and gives emphasis to the idea that all children are different and have different developmental patterns. I don't know of any growth and developmental studies in normal children in which physical growth and mental maturation are evaluated, thus allowing us to correlate the findings. The absence of this knowledge limits studies of this type in malnourished children.

The fact is that an individual may be classified as mentally deficient based on quantitative results of a test whose validity increases directly with the widening of the range it covers. For example, an I.Q. of 70 means any value from 54 to 80. In the case of normal children, an I.Q. of 100 with 95% validity covers any figure from 86 to 112.

If we keep in mind the fact that psychological tests are essentially objective and standardized measurements of a sample of behavior, and also that these tests simply indicate a statistical average which may or may not have significance for a particular individual, it is obvious that no definitive statement or prognosis as to the future can be made on the basis of one test alone. Furthermore, these tests often have not been standardized for the population to which they will be applied and cultural variation has not been taken into account.

Studies of preschool and school children pay no attention to some of the developmental disorders of motility and language which may simulate clinical manifestation produced by gross lesions of the brain. For instance, delayed development of speech resembles the expressive aphasia seen following lesions of the speech areas. The clinical picture of developmental hyperactivity is identical with that accompanying cerebral damage. Dyslexia, spelling disability, clumsiness and delay of speech are problems found frequently in pediatric practice.

I have mentioned five types of limitations that must be considered in these studies. In different degrees, they are present in

the majority of them. But for me, there is another one that is also very important—the evidence being built up through the accumulation of data which comes from different research groups who accept the validity of the results that may have the limitations already mentioned without the critical analysis. Finally, I would like to stress the importance of designing studies to test the proper role of environmental enrichment in order to establish the real significance of nutrition in growth and development of the human being.

SUMMARY OF RESULTING DISCUSSION

Effects of Intervention

In assessing the field studies reported in this session, the consequences of the Hawthorne effect must be considered in interpreting the results. Briefly, the Hawthorne effect suggests that any intervention will result in a change in a positive direction. When the effect involved is stimulation, this tends to be generalized for the individual. Thus, whatever aspect of the psychological structure of the individual is affected by the intervention, the whole psychological structure at this particular stage of development will be affected. The interpretation given to the data presented by the McKays suggests that this is not the most parsimonious interpretation.

The results reported by McKay, *et al*, indicate that their groups responded differentially as a consequence of the particular type of stimulation. One experiment, in which the children were stimulated for seven-and-a-half-hours a day, did not result in cognitive changes in the children. When there is change, there is a tendency towards regression to the mean in all groups. Change is most unstable for those measures on which there is a large and rapid change as a result of the intervention. Change tends to be more enduring on those measures when change is more difficult to achieve and initial movement is less. Change may be consolidated with a longer experimental program. One of the more important unanswered questions is why children who received an adequate diet, but no special stimulation, did not improve in performance.

While one would expect change in normal children—*i.e.*, children who are not malnourished—change would not necessarily be expected in malnourished children. This, and hence the interpretation of results from these intervention studies, depends in part on the hypotheses concerning the mechanisms through which malnutrition acts, and partly on whether the children are, in fact, rehabilitated from malnutrition. Studies in metabolic wards do indicate significant improvement in children with kwashiorkor in as little as eight weeks, measured biochemically and medically. There is also an increase in alertness. Hence, one would assume that children involved for longer periods of time would also be at a normal or near normal nutritional status.

These studies share many of the problems common to proj-

ects which attempt to facilitate intellectual development. They range from specific attempts to teach cognitive tasks, to broad based head start programs. Three questions must be asked of them: 1) do we get effects as a result of training or intervention, 2) do the effects last very long, and 3) are the effects due to the kinds of input that are designed into the program, or the result of unanticipated (and generally unmeasured) input?

Most of the literature is rather discouraging about the lasting effects of such interventions, even in groups that are not malnourished. As far as intervention studies with malnourished children are concerned, clearly they must continue for some period of time before definitive results can be obtained.

Analytic Problems

There are problems of data analysis in all of these studies. Many of the findings presented herein, and in reports presented elsewhere, do suggest that a multiple association exists between malnutrition, intellectual development, socioeconomic status, family life style and so on. The problem involves the making of choices concerning the meaning and importance of the relationships involved in the analysis.

Part of the difficulty arises from a need to know whether the most appropriate model is multicausal or interactive. In a multicausal system, any one or combination of a series of factors could create the outcome which is of interest, and the rest of the factors do not contribute much additionally to the outcome. For example, certain thresholds of malnutrition, poor family interaction or socio-cultural factors could each produce inadequate mental development. Intervening in one of these factors would not shift the outcome significantly. In an interactive system, each factor involved contributes, either singly or interactively, to the outcome. The consequences are essentially additive. Or, it may be that factors in different domains are multicausal, but the domains themselves are additive. Poor maternal-child interaction may produce negative effects on the child under any conditions. The effects may be greater when the child is malnourished, or the effect may exist only when the child is malnourished. It is important to know which of these alternatives exists for the children in these studies. The only way the effects of nutrition on performance can be understood is to place nutrition in some rational context.

Because so much of the data has been reported in terms of association of single items or in domains, factor analysis may provide one way to create some rational order within the complex of measurements. Factor analysis, however, is not of great help in decisions about causality.

Simple partial correlations may also prove useful. As an example, it was reported that there was a relationship between the performance in tests of intellectual behavior and the child's nutrition. The child's nutrition was, in turn, related to the mother's intelligence. One could use mother's intelligence as a control and do a simple partial correlation between the child's intelligence and nutrition, partialling out the common covariance of mother's intelligence. This means, in effect, that the determination is made of the relationship between the child's intelligence and nutrition, after taking out the influence of mother's intelligence on each variable.

Some of the newer multivariate techniques indicate the amount of additional variance which is explained by each additional variable fed into the system. Thus in Guatemala, one analysis studied the relationship between bone-age, housing, and performance on an imbedded figures test. Forced in that order bone-age accounted for 17% of the variance, and housing for 15%. Bone-age and housing are essentially uncorrelated. However, the order in which the data are entered into the analysis will determine the amount of variance which is left for additional items to account for.

Path analysis is another useful model. While this is a correlational technique, it does force the user to create a theoretical model, and is useful for testing alternative models.

These techniques require a relatively large number of subjects, and then are particularly useful when there are also a large number of variables involved. For smaller samples, and with smaller numbers of variables, matched-pair analysis is useful. In a matched-pair analysis, each subject is matched with a similar subject who does not have the characteristic one is studying. Thus, one could match a child hospitalized for nutritional disease with a child of the same age in school. When this is done, care must be taken to make sure that certain known crucial variables are included in the matching. In addition to being matched with age-mates in school, the child hospitalized for nutritional disease might also be matched with a child of normal nutritional status hospitalized for an orthopedic disorder. In this instance, this matching is particularly important because of the effect of extended hospitalization on psychological development.

It cannot be emphasized too strongly that the analysis of the data is best guided by the theories of the system being studied. It seems probable that the models being developed will require testing through longitudinal studies. Cross-sectional studies may provide leads—such as the possibility that response speed, which is an important determiner of success on many psychological tests, and impulsivity, which also relates to success on the tests,

differ systematically between well and malnourished children. There are, of course, important problems of matching and of statistical control in these studies. More important, however, is the fact that the development and the meaning of these differences can be understood only through longitudinal studies.

Problems of Interpretation

Given the present level of knowledge and understanding, discussion of the relationship between nutrition and mental development in both the popular press and the scientific literature tends to assume proof of a causal relationship. This is unjustified on the basis of our current knowledge. Even if such a relationship does exist, the mechanisms through which it is created are far from clear.

One example may suffice. There is clearly disagreement as to the effect of smaller head circumference on intelligence. Whole populations differ in brain size. Eskimos have the largest mean head circumference, the Japanese the smallest. Women, on the whole, have smaller brain sizes than men. There is no evidence that the group with the larger head circumference is more intelligent than the group with the smaller head circumference. Although the head circumference is smaller in malnourished populations, so are other body proportions. Nevertheless, it seems possible that the lowered intellectual performance of children with smaller head circumference is a consequence of malnutrition, which in itself is related to the socio-economic circumstances of the family. It is possible, too, that the malnourished child in the family is a deviant in some way—at least in some urban areas—and his behavior is a reflection of familiar patterns of interacting with him.

It is not necessary to assume that neurological dysfunction causes a difference in intellectual development between well and malnourished children. Malnutrition may limit activity and responsiveness in the child. This, in turn, will affect the amount of verbalizing he does, the nature of his interaction with his family, the amount he plays with his peers and his general social behavior. These are all experiences which will be reflected in lowered scores on many of the intellectual tests which measure his social and personal development. It would seem useful to develop measures of activity which will reflect these differences. The development of newer technology permits, for example, the use of a heart rate integrator which may provide one measure of energy expenditure.

III



Two Views on Cognitive and Intellectual Development

Cognitive development

Jerome Kagan

Assessment of cognitive development in deprivation and malnutrition

Francisco Cobos and Luis Guevara

Discussant's comments

Herbert G. Birch

Summary of resulting discussion

COGNITIVE DEVELOPMENT

by

Jerome Kagan*

Any discussion of cognitive development must deal with three issues—the concepts to be employed in understanding and describing this broad set of phenomena, measurement procedures, and the organizational changes that accompany development. We shall dwell most on the first of these issues for psychology is still in the critical stage of describing its fundamental constructs. We shall assume an analytic posture in this description and be concerned first with the potential usefulness of Q construct, rather than its ease of operationalization, an attitude that fortunately is gaining advocates among psychologists.

There are two distinctly different philosophical attitudes toward human thought. One view assumes that there is a psychological “executive” in the mind that continually monitors mental processes, much as an architect supervises the construction of a house. The executive decides what the problem is, selects the correct procedures, and judges when the work is done. The alternative view assumes that this monitoring function is contained within the mental structures and processes themselves, much like the reactions in a chemist’s beaker. The interaction of the chemical structures hydrochloric acid and sodium hydroxide produces salt and water; there is no executive force watching over this process to guarantee that the molecules combine in the proper way. The reaction is inherent in the nature of these chemicals.

American psychologists have generally been friendly to this second view and regard thinking as a more or less mechanical process. Others, especially Piaget, assume that higher order mental structures, more complex than schemata, symbols, concepts and rules, organize thought and keep it adaptive, coordinated and efficient. This second view has a strong appeal. The mind of the 10-year-old is stocked with hundreds of thousands of pieces of information; yet the mind, in its awesome efficiency, quickly selects the correct segment of knowledge and the precise mental routine when asked, “How many feet in four yards,” or, “How are a fly

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and a tree similar?" The following simple demonstration is persuasive of the need to assume a higher order process that is collecting and keeping track of what the mind is doing. Ask a child to listen carefully and then say, "8-3-9-1." Pause for three seconds and then say, "8-9-1." Ask the child which number was omitted in the second reading. The vast majority of children should answer, "3." How can we explain this simple event without assuming that a complex psychological process, something akin to an executive function, is keeping an orderly record of experience and is aware, most of the time, of what it knows and where to find it?

A useful approach to cognition asks four questions:

1. What are the units involved in cognition?
2. What are the dynamic processes that manipulate the units?
3. What are the purposes of cognition?
4. How does cognition develop?

Let us begin with the first question.

The Units in Cognition

The basic units consist primarily of: schemata, images, symbols, concepts, and rules.

THE SCHEMA

The schema, which is the child's first acquired cognitive unit, is a representation of the central aspects of an event. The schema is neither an image nor a photographic copy of the event, but resembles a blueprint in preserving the arrangement of a small set of significant elements. An experiment on four-year-olds may help the reader appreciate the meaning of schema. A four-year-old child is given a pile of 50 pictures cut out of magazines, most of which illustrate things he has no name for and finds strange. He looks at each picture for a few seconds, and when he has finished looking at all 50 he is shown a pair of pictures. One member of the pair was in the pile he had examined a few minutes earlier, while he has never seen the second. He is asked to point to the picture he saw earlier. Most four-year-olds are able to guess 45 of the 50 correctly. Some get them all right when tested two days later. Adults can look through 600 pictures and designate over 90 percent correctly. How is this possible? The child looks, for example, at a picture of a slide rule and a picture of a xylophone. He correctly points to the slide rule as the one he saw earlier. We assume that when he first saw the slide rule several minutes earlier a schema of its critical elements was registered. Now when

he looks at the pair of pictures, there is a closer match between the scene of the slide rule and the schema than between the xylophone and the schema, and "the match" allowed him to answer correctly. The potentiality for recognizing the slide rule was inherent in the schema.

A schema has two aspects—a constant component and a varying component. The constant component represents the class of schema to which the new event will be referred, and is analogous to the gross tuning on a radio receiver. The varying part is analogous to the fine tuning. Consider a child's schema for his *father*. The constant part is the general shape and size of the father's body and face and the color of his hair and general skin pigmentation. The varying component consists of the elements that can vary for that class of events, like clothes or length of hair.

An event is called *discrepant* when the constant components of a schema are unchanged but the varying components have been altered. Hence, if a schema for a regular human face has been activated (the child is primed to see a face) the appearance of a distorted face is *discrepant*, for some of the constant elements are present. The appearance of a checkerboard in a situation in which one is primed for a face is not discrepant at all. Psychology's task is to discover the sets of constant and variable components of events.

The capacity to recognize an event encountered previously rests with the constant part of the schema. The prolonged attention devoted to a discrepant event is a function of the varying aspect. The prolonged attention reflects the child's attempt to decide if the event belongs to a schema that he possesses.

As indicated in an earlier report (Kagan, 1970) the infant, whose initial concepts are schemata, represents his experiences by schemata which are composed of critical elements based on movement, contour, discrepancy and sensory feedback. Events with a set of common experiences form *schematic concepts*, which are to be contrasted with symbolic or more formal concepts, which we shall deal with later.

A schematic concept is a representation of common features across varied experiences that preserves some lawful and non-arbitrary relation to the original experience.

The bases for schematic concepts may include:

Common function

The child establishes a concept of *door* or *entrance* based on viewing "the entering and leaving of animals or people," or, he establishes a schematic concept for cups or silverware because he observes they have a common function.

Common instrumental responses

Here the common response is based on the fact that the child initiates a response toward the object or person. He *shakes* various rattles, he *hugs* furry animals, and these objects become concepts because of a *common* response issued toward them.

Common sensory feedback

Here the basis for the schematic concept is a common set of sensory experiences, either external (all milk is white) or internal (visceral afferent feedback).

These three dimensions: *common function*, *instrumental response*, and *sensory feedback* are among the major dimensions of similarity for *schematic concepts*.

IMAGES

A schema is not synonymous with a mental image. One has schemata for voices and musical melodies, as well as smells and textures. An image is a special and more elaborate structure, and more easily manipulated. However, like the schema, it preserves the unique pattern of physical qualities in the event. Perhaps the best way to regard the relation between *schema* and *image* is to view the former as the basic skeleton from which a more holistic representation can be built. The schema is the capacity to have an image when cognitive processes perform work on it. Let us now contrast the schema with the symbol.

SYMBOLS

Symbols are arbitrary names for things and qualities. The best example is the name for a letter, number or object. If the child in the previous example of memory had said to himself, "that's a ruler," his correct recognition on the test would have been facilitated by the possession of the symbol "ruler." The major difference between a schema and a symbol is that the schema is not arbitrary. It represents a specific sight or sound by preserving the physical relations that were part of the experience. The symbol, on the other hand, is an arbitrary coding of an event; it stands for something other than the event. The child who can name the arbitrary collection of lines we designate A, and can point to an A when asked, what possesses the symbol for that letter. The child who can remember that he saw the pattern of lines we call A but cannot name it, or point to it when we ask him, possesses the schema for A.

CONCEPTS

All concepts are symbols, but they are also much more than that. They stand for a set of common attributes among a group of schemata, symbols, or images. The concept extracts a common meaning from a variety of experiences; a symbol names one particular object or event.

Consider the drawing of a cross. The eight-month-old represents this stimulus as a schema. A four-year old calls it a cross and represents it as a symbol. An adult who regards it as the cross of Christianity and imposes on it a relationship to religion and church possesses the concept of "The Cross." The child, learning to read, initially learns the letters as symbols, and only later acquires the concepts for these letters. He first learns that "D" is the name for a specific line design. He learns later that "D" or "d" have a common attribute (they sound the same and are the first letters of dog and door). He has now learned the concept of this alphabetic letter. The child's spoken language is not always a good clue as to whether he is using a particular word as a symbol or a concept. If he uses the word "animal" to refer only to his pet dog and never to any other four-legged creature, the word "animal" is functioning for him as a symbol, and not as a concept. When he uses this word for a variety of four-legged creatures, he has the concept. A two-year-old who says he is "bad" when he soils his pants, but only when he soils his pants, is using the word "bad" as a symbol. If the child regarded a variety of acts as "bad" he would possess the concept. The critical difference between a symbol and a concept is that the former stands for a specific event or object; the latter represents an aspect common to several objects or events.

A concept stands for a characteristic of some event, not for a particular event.

The dimensions of a particular concept can themselves be concepts. Tail (which is a dimension of the concept dog) is itself defined by the dimensions, elongated, thin, flexible, covered with hair, and attached to the rear of a body. There is considerable arbitrariness in whether we call an event a concept or a dimension, especially for abstract concepts. The concept of justice rests on the twin dimensions: evil is defeated and good is victorious. But *evil* and *good* as concepts are defined by their own dimensions.

A concept is not always tied to a verbal name or language category. A ten-year-old may have experienced the feeling of resentment toward his father who frequently gave him orders. Whenever he encounters an older authoritarian male he experi-

ences anger and resentment. As he grows older he may think about this uncomfortable reaction and give it a name. He may say to himself, "authority bugs me." He has given the verbal concept "authority" to the dimensions "old—male—give orders," and has made the concept accessible to consciousness.

Attributes of concepts

There are four important qualities of a concept, apart from the meaning of its dimensions. These include degree of abstraction, complexity, differentiation, and central dimensions.

Degree of abstraction

Concepts whose dimensions are close to experience are usually called *concrete*. Hence, real objects like dog, cat, house and boy are represented by concrete concepts. Intelligence, fairness and corruption are more abstract because they refer to events that cannot be pointed to or experienced directly. Unlike concrete concepts, whose dimensions are usually physical attributes one can see, hear, or touch; the dimensions of abstract concepts are often other concepts. The concept of intelligence, for example, rests on the dimensions: language proficiency, alertness, adaptability, and learning ability. Each of these four dimensions is itself an abstract concept resting on its own set of dimensions.

Complexity of concept: number of relevant dimensions

Concepts also differ in the number of dimensions necessary to define them. Concepts that rest on many dimensions are regarded as more complex than those resting on only a few dimensions. The concept of society is complex for it is defined by dimensions that include schools, courts, churches, customs, laws, and family structure, and each of these dimensions contains many dimensions within it. The concept of *smoke*, on the other hand, is simpler, resting on the three dimensions: a wispy, gray substance rises in the air.

Differentiation

Concepts differ in the degree to which the same set of common qualities can assume varied forms. When this happens we have a set of closely related concepts that describe slightly different forms of the same idea. The concept rain, for example, is not very well differentiated, for our language does not have many names to describe different kinds of rain. The concepts shower, rainstorm, and drizzle account for most of the uses of this event. The concepts hammer or bottle-opener are even less differentiated. However, the concept house is highly differentiated, assuming many different forms, from hut and cabin through bungalow and house to mansion and villa.

Centrality of dimensions

Concepts differ in the degree to which the essence of their meaning is defined by one or two central dimensions that are absolutely critical to the concept, in contrast to concepts that rest on a few dimensions of equal importance. The concept *infant* rests on the central dimension of *age*. Although size, type of food eaten, and crying are relevant dimensions, infants differ in size, food intake and irritability. But all infants are under 18 months old. The concept of *tree*, on the other hand, rests about equally on the dimensions of trunk, branches, leaves, verticality and origin in the earth.

RULES

There are two kinds of rules. One type states a relation between two concepts. The rule "water is wet" says that the concepts water and wet are related, for one of the dimensions of water is the quality, wetness. Similarly, the rule, "showers occur in summer" or "men are taller than women" state a relation between two concepts. The rule is a statement about one or more of the dimensions of the concept.

A second type of rule is a mental procedure that is imposed on two or more concepts to produce a new one. Multiplication is a rule imposed on two numbers to produce a third. Consider the rule, "bombs are dangerous." This rule states a relation between the two concepts "bomb" and "danger." The rule describes the dimensions the two concepts share. This rule does not require that we do anything in order to note the relation. But consider the rule, "Place gunpowder and TNT in a metal case with a detonating cap and you have made a bomb." The relation among the concepts gunpowder, TNT, metal case, and detonating cap is not clear until one acts upon them and places them in a special relation to each other. The concepts are related by those actions. Hence, one class of rules involves a set of procedures that effect a relation; we call these procedures transformations. The first class of rules does not involve any transformation.

There is a second division of rules into *informal* and *formal*. Informal rules refer to an imperfect relation between two or more dimensions; the dimensions are shared some of the time, or perhaps, most of the time, but not all of the time. "Candy is sweet" is an informal rule, for occasionally one finds a candy that is sour. Most of our beliefs about the world are informal rules.

Formal rules state a relation between two dimensions that is always true and specifiable. The rules of mathematics are the best examples of formal rules that require an action.

There are, therefore, four major kinds of rules: informal

and nontransformational (candy is sweet); informal-transformational (melt chocolate and let harden to make candy); formal-nontransformational (a triangle has three sides); and formal-transformational ($6 \times 11 = 66$). Most of our everyday thoughts are composed of informal, nontransformational rules; most of science is composed of formal transformational rules.

The appearance of stages in the child's thought sometimes results from the fact that initially learned rules are difficult to replace. Like a scientific theory, they stubbornly resist retirement for they have been effective in the past, and are never replaced by criticism alone, only by a better set of concepts and rules. A rule acts like an organizer to which other qualities of experience are related. A thought or perception is a quickly constructed process that has a primary point of reference—a benchmark, in a sense. As the mind scoops up information—from the environment as well as from memory—in order to complete the construction, it automatically relates the new information to the basic point of reference. Suppose you read—or hear—the sentence, "Flying planes can be dangerous." If you focus on "flying planes" as the subject of the sentence, the rest of the sentence is related to it, and you understand the meaning to be that planes, as objects, are potentially dangerous. If, on the other hand, you focus on some assumed pilot of the airplane as the subject, the whole meaning changes and flying planes becomes an action not an object. The danger is to the unnamed *pilot*, not to some unnamed population. Once the point of reference is decided—and it is decided automatically—there is an immediate tendency to relate all other information to it.

This view is different from the one that has been prevalent in American psychology. The traditional view has conceived of a set of definite stimuli impinging upon the person and forcing him to experience specific events. The image is of Gulliver tied down by Lilliputians who are shooting "stimulus" arrows at him. The image we prefer has Gulliver up and about, wandering through the land picking up strange fragments of rocks, plants, and persons and trying to understand this new country by relating what he perceives to what he knows.

COGNITIVE PROCESSES

Cognitive processes include two very general types of thought—undirected and directed. Undirected thinking refers to free associations, dreams, or reveries, and the fluid flow of ideas that occur while a child is walking home, or staring out the window. There has not been much study of this exciting and important phenomenon because it is difficult to probe the private, undi-

rected stream of associations. Once you ask a child to report his free associations or to write them down, the situation is altered and the undirected thought suddenly becomes directed. The child views the situation as a problem and will *automatically* organize an orderly, coherent, and socially acceptable report of his thinking. The shift in question changes the nature of the phenomenon, and we do not see the disorder that often characterizes uncontrolled thought.

Directed thinking refers to the processes that occur when the child tries to solve a problem that is given to him or one he has set for himself. The child believes there is a solution to the problem and he knows when he has arrived at it. The problem solving process typically includes the following sequence: perception, memory, generation of ideas, evaluation, deduction, and, under special circumstances, public report. We shall consider each of these processes in that sequence.

It is helpful to keep in mind, as we embark on this journey, the general changes that characterize the period three through twelve years of age. The richness of the child's supply of symbols, concepts and rules increases each year, and these structures undergo continual reorganization as a function of experience. The child becomes increasingly concerned with the amount of agreement between his concepts and those of others; he becomes more apprehensive about making mistakes, and his ability to remember things he knows improves dramatically. Perhaps the most important change is that his conception of problems and the rules he activates to solve them gradually approach that of the adult community.

PROCESS 1: PERCEPTION AND UNDERSTANDING OF THE PROBLEM

Comprehension of the question must be the first process in all problem solving and necessarily involves selective attention to certain events and an organized interpretation of information. Although the child spontaneously interprets many events, the nature of his interpretation changes with age. The infant and very young child usually translate experience into schemata, while the older child is more likely to use symbols and concepts. The tendency for the child or adult to rely on the same set of units to interpret experience is part of a more general inclination toward inflexibility, a tendency to view a situation or problem in only one way. One child may be in the habit of regarding objects in terms of their functions, rather than the conceptual classes to which they belong. Various foods are "things to eat," rather than fruits, vegetables or cereals; animals are "things that bite," rather than sources of clothing or living creatures.

PROCESS 2: MEMORY

Memory is the storage of perceived experience. It had been assumed for many years that all perceived events were registered with equal strength. If a person could not remember something he perceived, it was assumed that the fault lay with his inability to recall it, rather than with its initial registration. Recent research suggests that we should distinguish between two memory processes—short-term and long-term memory. The information in short-term memory is typically available for fifteen seconds, and rarely more than a half-minute. Forgetting a new telephone number after it has been dialed is the best example of short-term memory. Unless one makes a special effort to transfer the information in short-term memory to long-term memory some, or all, of it is lost and cannot be remembered at a later time.

PROCESS 3: GENERATION OF IDEAS

The comprehension of a problem and remembering it are typically the first two processes in any problem-solving sequence. The third process is the generation of possible solutions, thinking of alternative ways to solve the problem. When these ideas are unusually good, we call the author creative. In order to generate good ideas the child must possess the right set of schemata, images, symbols and rules; freedom from the fear of making a mistake; and a more mystical ingredient we call insight. The child is motivated to seek solutions whenever he encounters a situation he does not understand or a problem for which he does not have an immediate answer. The child sees his mother weeping or watches a bird unable to fly. Each event creates a state of uncertainty, for the child does not have an easy rule or concept to explain the event, and to persuade him that he understands why it occurred. As indicated earlier, the child wants to resolve uncertainty. He wants to understand. In order to find an answer he dips into his reservoir of knowledge and searches for structures that will enable him to explain the event.

How does the child know when he has explained an odd event or solved a problem? The child first searches his set of mental structures for possible causes of an event he does not immediately understand and generates a possible explanation.

He then checks this new interpretation for consistency with his older rules about the event. If the explanation he has chosen contradicts any of the older rules—which means that he has stronger faith in his older rules than in the new interpretation—he is likely to reject the new hypothesis. If he finds an explanation that both matches his experience and does not contradict earlier rules, he is likely to accept it as correct.

Two requirements are critical—possession of a set of rules appropriate to the problem and, the absence of a firmly held rule that contradicts the correct solution. Some children fail to generate good solutions because they do not possess the relevant ideas. Others fail because they run up against more strongly held rules that contradict new explanations; still others because their confidence is so limited they are always unsure about new hypotheses, and rarely implement or offer them.

Between seven and eleven years of age, the child shows an increasing ability to generate possible explanations of hypothetical events that violate his everyday experience. Consider an example close to the life experiences of children. Suppose a teacher posed the following problem to one group of second graders in rural Alabama and another group in New York City.

"A man is in a log cabin on a cold, windy night. All he has with him are some old newspapers, and a pot of glue. What should he do to keep warm?"

The solutions generated by each child can be traced to his life experiences. The lower class rural child is more likely than the urban one to suggest that the newspapers be glued against the window to keep out the wind, for he has seen this technique used with profit. This suggestion is less likely to come from the urban child because, in his experience, windows are usually intact, even in an urban slum.

Assuming the potential capacity for generating creative explanations, there are two major obstacles to its production. First, a set of firmly held ideas inconsistent with the required solution can lead to rejection of the creative idea, should it occur. Second, anxiety over possible criticism for suggesting an unusual idea can be inhibiting. These two processes are quite independent of each other.

PROCESS 4: EVALUATION

Evaluation refers to the degree to which the child pauses to evaluate the quality of his thinking and the accuracy of his conclusions. The process influences the entire spectrum of thought, including the accuracy of perception, memory and reasoning. Some children accept and report the first hypothesis they produce and act upon it with only the barest consideration for its quality. These children are called impulsive. Other children devote a long period of time to considering their ideas and censor many hypotheses. These children are called reflective. This difference among children can be seen as early as two years of age and seems to be relatively stable over time. (Kagan and Kogan, 1970)

Matching familiar figures as an index of evaluation

One of the tests used to assess the child's tendency to be reflective or impulsive is called the Matching Familiar Figures Test. The child is asked to select the one picture in the set of six variations that is identical with the standard. The examiner records the number of errors he makes. Among American children there is a decrease in errors and a corresponding increase in time taken to decide across the span five to twelve years of age. Typically, the faster the child makes his decision, the more mistakes he makes. Impulsive children who respond quickly (under five seconds) and make many errors (one or two per test item), in contrast to reflectives who respond slowly (over twenty seconds) and make few errors, behave differently in school. Reflective children wait longer before they describe a picture, delay longer in answering a question posed to them by an adult. They are less likely to report words that did not appear in a list that was read to them, are less likely to make errors in reading, and make fewer errors in reasoning tests (Kagan and Kogan, 1970).

Fortunately a child's disposition to be reflective or impulsive can be modified through training. One group of impulsive children were told to *slow down* and *think* before they gave their answers. After several half hour training sessions, the children were more reflective than untrained impulsive children.

The teacher's tendency to be either reflective or impulsive can also influence the child. Each of twenty first grade teachers was classified as reflective or impulsive on the basis of performance on an adult version of the matching familiar figures test. Then a random group of children from each of the twenty classrooms was tested in the early Fall and again in the late Spring to determine if exposure to a reflective or impulsive teacher influenced the child's behavior. The children changed in a direction consonant with the tempo of their teacher, the effect being most marked for impulsive boys in classrooms with teachers who were reflective and had many years of experience in the classroom (Yando and Kagan, 1968).

The Basis for reflection-impulsivity

One of the factors behind a reflective or impulsive attitude is fear of making a mistake. The greater the child's apprehension over an error, the more likely he will be reflective. Reflective children are concerned with correctness and wish to avoid error at all costs; impulsive children seem minimally apprehensive about making a mistake and, as a result, respond quickly. Most American school children become reflective with age because our culture

encourages them to be cautious about error and to avoid the humiliation of being wrong.

PROCESS 5: IMPLEMENTATION OF HYPOTHESES: THE DEDUCTIVE PHASE

The processes of hypothesis generation and deduction are often complementary and are regarded as the essence of thinking. Generation of hypotheses and deduction of conclusions often occur together, for to realize that both coral and butterflies are living creatures is simultaneously to deduce that each grows and will eventually die. Deduction is the application of a rule—formal or informal—to solve a problem. Hence, the most important set of mental structures controlling quality of deduction is the child's storehouse of rules, which typically increases with age.

The issue of stages

The central theoretical question asks whether there are basic changes in the child's understanding and use of rules as he matures from the preschool years through adolescence. As indicated earlier, some assume that the child merely learns more good rules each day, storing them for future use, and there is no rule that is necessarily too difficult for a child of any age to comprehend and apply appropriately. The alternative view is that some rules are inherently too difficult for young children and there are maturational stages in the development of thought.

Professor John Flavell (1970) has recently performed an interesting analysis of the development of types of concepts and rules that illuminates the problem. Flavell suggests that:

... cognitive development can proceed in five different ways—through addition, substitution, modification, inclusion, and mediation. In the first, the child merely adds a new idea to his structure of facts (e.g., he learns that baby swans are called cygnets). In the second, a new idea replaces an older one (e.g., the seven year old learns that a given amount of candy remains the same amount regardless of how many pieces it is broken into). In the third, an old idea is modified or transformed (e.g., the child learns that all men are not fathers, only men who have children). In the fourth, an idea is related to a larger set of integrated beliefs; a concept that was initially separate becomes included into a larger system (e.g., the child learns that plants are also regarded as living, where previously he thought that only animals were alive). Finally, in mediation, an idea suggests another idea but is not a part of it (e.g., the child learns to give himself verbal instructions to slow down and be careful while he is doing an arithmetic problem, and this self-instruction does help his performance, although it is not part of the performance).

It is likely that this profile of developmental change is different for each of these five fundamental mechanisms. But Piaget makes a stronger statement than Flavell about changes. Piaget claims that each stage is continuous with the earlier one. This view is clearly controversial. We acknowledge that beginning at about 18 months of age symbolic concepts emerge and these may be derived from schematic concepts, and even begin to replace them. But symbolic concepts are arbitrary, since they are primarily linguistic, and nested in the structure of the particular language system the child is acquiring. Some of the major symbolic concepts include good-bad, male-female, natural-unnatural, wild-tame, active-passive, strong-weak, strange-familiar, letter-numbers. Symbolic concepts can of course be tied to direct experience (e.g. as in the concepts male and female), and this is a process that is analogous to, but of course not identical with, Piaget's notion of *concrete operations*. Other symbolic concepts are derived not from experience, but from other symbolic concepts, a process analogous to Piaget's formal operations.

The concept *male*, therefore, can be a schematic concept for an infant (based on hair, voice, and sensory effects). But *male* can also be a symbolic concept if it is used by the child to refer to particular people who have a common function. *Male* may also be a formal concept based on dimensions like internal anatomy and genetic structure. Thus, it is important to ask if a person can have a formal concept of male without ever possessing the earlier schematic concept. It is possible to answer this question affirmatively. Thus a blind child can learn that a male is a person with an X and a Y chromosome, without ever possessing a schematic concept involving the external physiological characteristics of male. We are still not sure how a schematic concept becomes transformed to a symbolic or formal one. It is believed that the child first has to learn the arbitrary code for symbolic concepts, which take control because they are more efficient. Symbolic and formal concepts organize more information and leave less uncertainty in the system.

It should be noted that this argument forms a nice analogy with the evolution of language, which began with logograms. Early man constructed a logogram for mother, for example, which was replaced with a syllabary form (which we might regard as the symbolic concept), which was replaced by the formal linguistic concept of mother. However, there seems to be nothing in the acoustic or graphemic quality of m-o-t-h-e-r, which is the last development in the evolution, that is related to or includes the original logogram.

One can question Piaget's assumption that all formal operations are derivative from earlier sensory-motor schemes. This as-

sumption may be true, but it is neither intuitively commanding nor empirically justified at the moment. It must be said, however, that there is good reason to believe that at the periods of 12 to 18 months, 5 to 7 years, and 11 to 13 years, important cognitive changes occur. These nodes compare with Piaget's postulation of sensorimotor, concrete, and formal operations. We must now discover the exact nature of these changes and determine why there is a dramatic alteration in cognitive function at this time. A primary mechanism for change is the fact that the child does not like inconsistency. Experience and his own thought lead him to see inconsistency in his beliefs and he must resolve it. In so doing, cognitive change occurs. Why inconsistency has this effect is still a mystery.

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ASSESSMENT OF COGNITIVE DEVELOPMENT IN DEPRIVATION AND MALNUTRITION

by

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The clinical picture of protein-calorie malnutrition, the most important variety of malnutrition today, has traditionally been linked to a low level of food availability. It is commonly associated with poverty and the inability of the malnourished to purchase needed nutrients.

Recently, however, emphasis has been placed on the importance of other ecological factors such as the physical health of children suffering from malnutrition. (Scrimshaw, 1967).

The correlation between general factors such as the physical ecology of the community, family dynamics and other social variations, and the nutritional status of children, has been known for a long time (Benedict, *et al*, 1919; Blanton, 1919), but has not been adequately considered.

Students of human behavior have long stressed the importance of psychological factors, and particularly motivation, in the ingestion of food, and hence in nutritional status.

The psychiatric literature has emphasized the impact and interaction of psychological contents upon psychological functioning, particularly in areas related to basic drives, such as the ingestion of food. Clinical anorexia nervosa serves as one example of these relationships. Cases of failure to thrive syndrome (Powell, Brasel, Raiti, and Blizzard, 1967) present a complex situation in which psychological factors combine with family factors to contribute to malnutrition and psychopathology.

The multifactorial causation of malnutrition leads to the conceptualization of clinical malnutrition as a complex system of interactions, a network-like, pulsating system, which can be represented in the following manner:

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N: (FI). (H). (PS). (FF). (SG).

in which: N = Nutritional status of the individual
 FI = Food intake
 H = Physical health
 PS = Psychological factors
 FF = Family function factors
 SG = Social group function factors

All the elements in this equation are related to one another and to the total system in a manner not totally understood. Furthermore, each of the elements is itself a sub-system, although the exact composition of these sub-systems is unknown. For example, food intake is dependent upon food availability, which in turn is linked with economic status, family size, food habits, and other factors.

This conceptual model suggests that malnutrition is the result of the mutual interaction of several factors, some or all of which are present at a suboptimal level, or are not in equilibrium. Childhood malnutrition is therefore related to social and psychological events, and will rarely be present as a result of the alteration of a single factor. Frequently, clinical malnutrition will be accompanied by varied degrees of deviation of one, several, or all the factors included in the model. This unified approach may clarify a situation in which one factor is assumed to be the cause of malnutrition when, in fact, it is the main contributing or most visible one in the etiology of a single clinical case of protein-calorie malnutrition.

The model is also useful in showing that changes in any given factor will affect, in varying degrees, the others. Thus, changes in health, in family dynamics, in the functioning of the social group or in nutritional status will be followed by psychological changes. There are no indications whether these psychological variations are reversible and, if so, under what conditions.

This conceptualization implies that the question of whether or not malnutrition affects the psychology of the individual is not the central one. The important issues are the characteristics of the relationships and the dynamic conditions of the system in each case. Therefore, analysis of the role of malnutrition in mental functioning should be undertaken only in terms of the system *in toto*, and never as a frozen, static, one-to-one correlation.

The model also permits the examination of malnutrition within the framework of general concepts of deprivation. This situation may be described as a continuous flow of interacting events related to the vital conditions of the individual, his family or his social group, basically reflecting the lack or inappropri-

ateness of those physical, psychological and social elements indispensable to the achievement of functionality through the optimal development of the individual.

Goldfarb (1955) in describing general deprivation of infants, noted that there is a family psychological climate, within which the child experiences the mother as a source of safety and gratification. She brings release from physiologic tension and discomfort through a multiplicity of maternal operations, including cleaning, handling, fondling, rocking and, principally, feeding. Children who do not have this type of experience may be described as psychologically deprived. This deprivation affects both thinking and feeling, and leads to a lack of differentiation and development of all aspects of personality.

It is thus possible to hypothesize that since malnutrition may be conceived as only one facet of the picture of general deprivation, the psychological damage associated with malnutrition may, in reality, be secondary to other components of the syndrome of deprivation. As a matter of fact, some of these components, such as maternal deprivation, are universally accepted as potent stresses to human developmental progress.

On the other hand, early deprivation of proteins has been shown to result in organic deficit in the central nervous system (Winick, 1966) as well as in other signs and symptoms suggesting structural alterations of the brain (Monckeberg, 1968).

We have assumed that psychological malfunction associated with protein-calorie malnutrition, and restricted performance as a consequence of organic damage produced by nutritional deficiencies may be present singly or in combination in malnourished subjects. Which, in fact, occurs, depends on other factors such as food intake, general physical health, previous psychological status, family dynamics, societal forces, etc., as well as other general conditions, of which the age of the subject when the episode of malnutrition occurs may be of decisive importance. Thus, psychological malfunction emerging from two very different pathways can be added to the numerous and complex elements causally linked to the clinical pictures of protein-calorie malnutrition. The investigation of this complicated situation calls for psychometric instruments able to offer some suggestion as to the differential types of psychological deficits which may follow malnutrition, as well as refined research design and powerful instrumentation for data analysis.

Before suggesting some possible approaches to the solution of this psychometric problem, it is necessary to consider some other aspects of the general problem of the association between malnutrition and psychological deficit.

It is important to consider the differences and relationships

between the behavioral sequences involved in feeding and nutritional status. Feeding is a series of acts and transactions leading to the ingestion of foodstuff, while nutrition is a clinical descriptive notion qualifying states of general health which depend on food ingestion. The notion that normal nutritional status ensues from appropriate feeding is a complicated one from the psychological viewpoint, since feeding is essentially a behavioral event, while nutrition is a clinical situation. Therefore, it is obvious that nutritional variations will be closely related to the feeding patterns of the child. These situations are not optional for the child, but are for the care-giving individual.

The feeding sequences are bipolar or dyadic behavioral events in which both poles are of at least equal importance. As a matter of fact, feeding can be thought of as an open system, with multiple feedback areas and a developmental process which tends to place the subject in a progressively optional position. The highest degree of dependency is seen in the newborn, who depends entirely for his feeding, and therefore for his nutritional status, on his mother and who has no option whatsoever as far as the feeding act is concerned. On the other hand the opposite situation is found in the normal adult, who depends only on himself for feeding and, therefore, for attainment of a normal nutritional status.

This situation of variable dependency is of importance as a dynamic psychological element, since in the last instance the feeding behavior and the nutritional status of the child depends on the psychological nature of the dyadic counterpart, be it the mother, the family or the social group, according to the level of development.

It is redundant to mention that food availability is just, in the last analysis, a result of human behavior, reflecting psychological functioning of one or more individuals. It is naive to assume that most cases of malnutrition are simply the result of lack of food, reflecting poverty, suggesting that no psychological or sociological transactions are involved and that the only cure for this scourge is the defeat of poverty. This fatalistic notion is unrealistic and may represent a defensive rationalization for the malnutrition that is present in well-developed, wealthy societies.

The simplest model for exploring the intimate interactions of the feeding act is provided by the framework of the mother-child relationship. Under normal conditions certain basic needs of the newborn, such as those associated with the act of breathing, are absolutely independent of the human environment. Others, such as food, must always be provided by human individuals. The satisfaction of the alimentary needs of the infant is one of the most important maternal chores, and necessary for the child to sur-

vive. Failure to fulfill such tasks reflects variable degrees of failure of motherhood. It is important to note that other events which foster development in the affective, cognitive or social domains are totally dependent on interaction with the mother, whatever their nature may be. Thus, feeding interaction becomes a vehicle for drive satisfaction, as well as for development-provoking stimuli. In the language of Scott (1968), the epimeletic system of the mother is enmeshed with the ingestive system of the offspring. Brody (1956) has demonstrated the central position which the act of feeding has in the mother-child interaction system. As a matter of fact, she stressed that the feeding behavior is the most representative of the maternal repertoire, as compared with others such as cleaning, playing, etc. Brody pointed out the importance of the maternal activities leading to the feeding of the child in the formation of the future character and personality. Thus, it seems redundant to emphasize the overwhelming impact that alterations of such maternal behavior will have on the future psychological functioning of the child, regardless of whether or not the deficit of feeding activities has led to clinical malnutrition. At this level, the failure of the mother to satisfy the nutritional needs implies simultaneously the deficit in nutrients as well as in maternal care.

On the other hand, according to Freud (1949) the feeding act is the resultant of the stimulation of basic instinctual drives generated by the biological need for nutrients of every living structure. Both hunger and oral pleasure represent motivational forces leading the subject to the fulfillment of the nutrient requirements, through the feeding act. The survival value of the behaviors directed at satisfying these needs are of extreme psychological importance during the first years of life, to the point that oral ingestion becomes the archetype of all psychological functioning for this age group. Deviations in the normal course of the development of orality lead to various degrees of impairment of ego integration. Not only may the development of affective functions be impaired, but there also may be interference with the appropriate stimulation needed for future normal intellectual performance. Once more it becomes obvious that the lack of differentiation between purely physiological and purely psychological components of the organization of the child at this age makes it impossible to establish causal links between malfunction which is secondary to deficits in the intimately fused maternal and nutritional functions, and any single other component.

Such deficits will undoubtedly be reflected in affective as well as intellectual performance, with both being dependent on the appropriate stimulatory input. Corman and Escalona (1959) have recognized that, in all probability, even minimal, non-specific, in-

teraction with the external world may be sufficient to induce the appearance of the cognitive structures and, therefore, result in normal cognitive development.

The situation in which feeding, and hence nutritional status, is seen as an integral part of maternal function is duplicated at older ages in the interaction between the child and the family. The processes of secondary socialization of the child require, as an essential infrastructure, the fulfillment of the basic needs of the preschooler, in terms of protection against undesirable ecological threats, satisfaction of nutritional needs, provision of adequate stimulation in the form of schooling, etc. It is in providing these elements which are necessary for the achievement of genetic potentials, that the family fulfills its role in front of the developing child, and it is through the interactions which satisfy such needs that the socializing processes occur. Failure in attending to the needs described will lead to exposure, illness and other trauma by ecological agents, to hunger and malnutrition, and to poor psychological performance culminating in arrests in socialization.

In older subjects, a similar process occurs when the interaction between the individual and the social environment is altered. The mere existence of the social group already points out the high survival value of this structure. The functions of the social group include the facilitation of access to food, as well as various forms of protection. When the individual suffers hunger and subsequent malnutrition, the failure of the social group to protect him against such contingencies is being exposed. The sequelae of such a sequence of events, manifested as a restricted ability to carry on the psychological functions of the adult, or as restricted productivity, is related not only to the effects of malnutrition but also to the impoverished functioning of a defective social group.

Thus, with the theoretical tools available today, it is possible to hypothesize that deprivatory phenomena, including the nutritional component, will lead to deficits of psychological functioning, mainly in affect and in performance on tests requiring previous stimulatory input. On the other hand, the development of the structures underlining intellectual functioning requires general interaction with the environment but not specific, culturally-bound stimulation. Therefore, it may not be as affected by deprivation as by direct organic damage to the central nervous system such as that which malnutrition may generate.

It is generally accepted that there is a sizeable difference in traditional I.Q. between low and middle class subjects, in favor of the higher socioeconomic level, or between negro and white children, in favor of the not discriminated against group. These differences are the result of deprivation and do not reflect inferiority.

ties inherent in low social class or racial minorities. It is also accepted that there is an important impact of lower class or of racial minority status on affective development of children. On the other hand there is no evidence whatsoever supporting any impairment in the development of the basic structures of intelligence associated with social class, race, nutritional status or even general health.

These conceptualizations lead us to believe that meaningful studies of the intricate network of relationships among deprivation, malnutrition as one partial aspect of deprivation, and the changes induced by them on the developmental progress of the psychological apparatus must take into consideration not only the areas of psychological functioning which we suppose will be altered, but also those structural elements which are not basically influenced by deprivation but which deviate under the impact of organic damage.

Furthermore, it is necessary to point out that any type of deprivation, including nutritional, is in essence an affective event. The frustration of the satisfaction of basic drives leads to fixation or regression of developmental forces in the emotional area. As a matter of fact, basic knowledge of deprivation came from studies centered on emotional development. Karl Abraham (1949), for example, has described how the deprivation of oral satisfaction greatly contributes to the generation of character disorders.

From this point of view it may be noticed that frustration of basic drives, such as is experienced during food deprivation, in reality reflects the functional loss of the object. This transcendental psychopathological situation is intimately connected with deviations in the management of aggression and with the emergence of clinical varieties of depression.

The previous considerations suggest that an appreciation of the psychological changes which may occur in connection with malnutrition should at least be able to give insights in the following areas:

1. Performance of those culturally determined learned tasks which are correlated with age, and generally taken as indicative of "intelligence." Performance on measures of these learned tasks is fundamental in the construction of traditional psychometric instruments for measuring intelligence.

Basically, such behaviors represent the output of some process requiring a previous input. The lack of these stimuli is the essence of deprivation. In the past, the resulting mental retardation has been accepted and given varied names (Low mentality, Psycho-cultural retardation, Familial mental retardation, Psychogenic mental retardation associated with Environmental deprivation, etc.).

The reason for paying special attention to this clinical type of mental retardation in this context, is the fact that its presence is correlated with such familial and social conditions as are found concomitantly with malnutrition. Poverty, cultural disadvantage, racial discrimination, malnutrition, etc. are usual accompaniments of such deficits in psychological performance. Without the intimate knowledge of how much a subject has been retarded by a deficit of stimulation it would be impossible to determine the intensity of the retardation, if any, caused by malnutrition.

It should be stressed that the nature of these deficits is determined by local cultural conditions. Therefore, the instruments used for its assessment should be culturally congruent. There cannot be interchangeability of such instruments, and transcultural comparisons are highly deceptive. These characteristics of the traditional I.Q. measurement do not require further comment in view of the recent pertinent literature (Jensen, A.R., 1969). (See also: Discussion: "How much can we boost IQ and scholastic achievement?" *Harvard Educational Review*. Vol: 39:2, 1969).

2. The development of some area not requiring specific external input or stimulation. It is clearly understood that any developmental event will depend on the interaction of inner, genetically determined, maturational capabilities with unspecific environmental stresses. The output of such developmental processes will be in terms of general abilities rather than specific behaviors congruent with the surrounding culture.

For example, the observation that a child is able to use a spoon to eat at a given age reflects both that this child has been taught this behavior is desirable within the culture in which he lives, and that this performance has appeared at the age at which most children in the local culture learned the behavior in question. Its appearance at early ages is understood to mean higher intelligence while retardation is diagnosed when the behavior is not present at the age at which it is found in most children. On the other hand, regardless of the pressure of the cultural stimulation, events such as holding the head up, being able to run, being able to classify, etc., will appear in most neurologically undamaged individuals according to certain sequences and within certain age ranges. Most environments, as noted before, are able to provide the non-specific stimulation needed for the generation of such developmental sequences.

It is generally accepted that cognitive development as described by Piaget (1926, 1927, 1947, 1956, 1963, 1966) may fulfill such conditions if the difficulties inherent in the construction of psychometric instruments based on his theories are overcome.

The combination of the traditional IQ scores with assessments of cognitive development will provide useful information

for evaluating the impact of one of the components of the total picture of deprivation on psychological functioning. Although low IQ scores will accompany cognitive damage, retardation due to lack of culturally-bound stimulation, resulting in moderately low IQ values, will not, in most instances, be accompanied by cognitive underdevelopment. This situation permits some useful discriminatory analysis leading to the identification, at least partially, of the effects of malnutrition.

3. Finally, emotional functioning, in a well defined area, will provide greatly needed insights. Since measurement is extremely difficult, the assessment of possible affective deficits will have to be limited to techniques which may be easily standardized. The recent literature on the subject of emotional attachment (Bowlby, J., 1969), as well as the common observation that malnourished children have marked difficulties in relating to examiners, suggest that the measurement of the development of object relations may be of value. The argument that disadvantaged children do poorly on many tasks because of inability to relate to the tester is an old one and may reflect important dynamic events.

Since the subject of development of traditional IQ instrumentation is so rich, the stress here will be mainly on devising psychometric scales for assessing cognitive development of children.

The search for an efficient approach to the problem of knowledge led Jean Piaget to the formulation of a theory of the development of human cognition. This theory has withstood the test of several decades of investigation, as well as conceptual criticisms from varied sources. Piagetian developmental psychological theories have been widely accepted and are being examined for practical application.

Scientists in the educational field are aware that the genetic approach may be useful in the acceleration of the stage sequence of development and in the planning of curriculum changes for formal childhood education. One factor limiting the implementation of these applications is the lack of an efficient diagnostic procedure for evaluating the current level of cognitive development of a given subject. It has been suggested by Inhelder (1968) that curricular changes based on Piagetian psychology should consist mainly of the fitting of the offered stimuli to the current cognitive structures of the child. This requires a knowledge of the level of development (diagnosis of the stage), and of the appropriateness of the stimuli for that level of development.

A second important application of Piagetian psychology is related to the frame of reference used by professionals dealing with psychological deviations in children. Child psychologists and

psychiatrists are becoming aware that an intimate knowledge of specific areas of human development (such as that offered by the genetic approach) is indispensable in the conceptualization of psychological malfunction. Important efforts have been made (Wolff, 1960; Cobliner, 1967) to integrate Piaget's notions with psychoanalytic thought. Comparisons have been made of well-defined areas of development, as seen from psychoanalytic, Piagetian, and traditional psychometric viewpoints. (Gouin-Decarie, 1965). The simultaneous use of these approaches strongly suggests that it is possible to integrate them into instruments capable of evaluating a broad aspect of human development. However, the availability of an instrument capable of specifying deviations in cognitive development is a prerequisite for progress in this direction.

Third, the very existence of a theory of development creates the need for a practical way of assessing its validity. Accurate and valid measurement of the stages of development will ultimately lead to the proving or disproving of their sequence, hence testing the validity of the theory.

There is concern that the development of measurement techniques will result in an overemphasis on psychometric techniques, and hence lessen interest in theory development. There is also concern that instruments based on Piaget's theories may suffer the same unrealistic reliance on the child's answer, rather than his method of reasoning, which characterizes most present day intelligence tests.

However, the developmental diagnosis arrived at from the use of measuring instruments based on Piaget's theories is the beginning of the psychometric evaluation of the development of cognition. The clinical comparison of levels of development between individuals is in itself the beginning of the seemingly forbidding task of "psychometrizing Piaget." On these grounds, a number of investigators interested in developmental psychology have believed it worthwhile to develop practical measures of cognitive development. Pinard and Laurendeau (1964) working closely with Piaget, as well as other scientists working independently, have been devising such instruments.

For several years these authors have been conducting a project at the Laboratory of Genetic Psychology at the University of Montreal, aimed at assembling a "Developmental Scale" based on Piaget's theories, with two main objectives. On one hand it looks for confirmation of some of Piaget's developmental principles in populations different from the restricted ones reported in the original descriptions, and under very strict conditions of objectivity and standardization. On the other hand, and as by-product, the project has attempted to build an ordinal scale of

cognitive development applicable to children two to twelve years of age.

In a similar pathway, Corman and Escalona (1969) have developed a scale of sensorimotor development applicable to children below two years of age.

The construction of these scales has implied a deviation from traditional techniques of test construction which assume each period of six to twelve months of chronological age makes a difference in mental development large enough to be measured in some valid way. The builder then tries to assemble varied and sufficiently numerous problems so that subsequent statistical analysis will allow the retention, at each age level, of a group of adequately difficult and valid items.

In order to avoid the artificiality introduced in the building of scales by such methodology, it was necessary, in the case of the scales based on the Piaget's theories of cognitive development, to reverse the traditional methodology by first making a thorough study of the development of thought in order to pinpoint the different stages of cognitive development, as well as the specific characteristics of each one of them. Once this theoretical framework was available, problems were constructed to elicit behaviors that would reveal the presence or absence of such specific characteristics. Statistical analysis then determined the age at which each one of such stages appear. Normalization of the scales implies finding out the average age at which the different stages are found in a given population. Evaluation of the cognitive situation of a given subject requires comparison of the speed of his cognitive development compared with that of the general population of the same age. The details of the construction of the two types of scales referred to in this paper have been published by Laurendeau and Pinard (1962, 1968).

With the objective of assessing differences in the characteristics of the cognitive development which may discriminate between malnourished and normally nourished, but otherwise similarly deprived populations in Bogota, Colombia, Piagetian instruments based on some of the original work done by Pinard, *et al.*, and the scale for examination of the sensorimotor development devised by Corman and Escalona, have been used in the Harvard-ICBF-Cornell Project on Malnutrition and Mental Development. This latter is applicable to children ages 0 to two years old and is now known as the Einstein Scale of Sensorimotor Development, while the first is known as the Montreal Scale of Cognitive Development and is usually administered in two separate formats, depending on age of subjects. (Montreal I and II). This scale is designed to elicit behaviors from which the stages of sensorimotor development of a given subject may

be inferred. The behavior or behavioral sequences explored are related to the development of either Prehension, the notion of the Object and the notions of Space. Therefore, the assessment of the level of sensorimotor development a child has reached is assessed on the basis of the progress achieved in any single, or in any combination, of these three sub-scales.

Table No. 1 summarizes the general structure of the Einstein Scale with the location of the sub-scales, the general age range for each stage as suggested by Piaget's studies, and a brief description of the most important structural characteristics detectable within each sub-stage. The number of items for each

TABLE 1
General structure of the Einstein scale of sensorimotor development
Sub-scale

1. Prehension	2. Object relations	3. Spatial
Stage II Primary circular reactions Age: 1-4 months Sub-stages: 1 to 4 Stage IV Secondary circular reactions Age: 4-8 months Sub-stages: none	Stage III Secondary circular reactions Age: 4-8 months Sub-stages: 1 to 4 Stage IV Coordination of schemata Age: 8-12 months Sub-stages: 1-4 Stage V Tertiary circular reactions Age: 12-18 months Sub-stages: 1-5 Stage VI Initial representations Age: 18-24 months Sub-stages: 1-11	Stage III Secondary circular reactions Age: 4-8 months Sub-stages: 1 to 4 Stage IV Coordination of schemata Age: 8-12 months Sub-stages: 1-8 Stage V Tertiary circular reactions Age: 12-18 months Sub-stages: 1-11 Stage VI Initial representations Age: 18-24 months Sub-stages: 1-6
No. of items Stage II: 18 Stage III: 6 Total 24	No. of items Stage III: 4 Stage IV: 5 Stage V: 5 Stage VI: 11 Total 25	No. of items Stage III: 4 Stage IV: 8 Stage V: 11 Stage VI: 6 Total 28
Number of items per stage:	Stage II III IV V VI	Items 18 14 13 16 15
Total No. of items in the three sub-scales: 76		

sub-scale, for each scale and the total for the complete instrument are also shown.

In order to classify subjects on their cognitive progress as well as to compare groups, it is necessary to approach these comparisons by following some statistical guidelines. Such attempts should take into consideration all theoretical aspects and should be in close agreement with the basic principles of Piagetian psychology. The theory should guide the interpretation given to the results obtained before they may be considered as true scores. The theory should also determine the most appropriate statistical and analytic procedures to which these scales may be submitted.

These principles are naturally applicable not only to the Einstein Scale of Sensorimotor Development but also to the Montreal Scales of Cognitive Development.

The Scale thus generated is an ordinal one, with units which are not equivalent, since the theory prescribes the diachronicity of the stages and the eventuality of levels of difficulty or sub-stages.

At the present time the most advanced scales based on Piagetian psychology are the results of the investigations of Pinard, Laurendeau, *et al*, at the University of Montreal. Their efforts to submit Piaget's observation to controlled experimental conditions, as well as to construct an ordinal scale of cognitive development based on such experimentation, have been described in detail.

The original work was based on the use of a battery of 57 sub-tests, including some 300 possible levels of response. All the items included have either been taken directly from Piaget's work or have been inspired by those already in use in conventional scales. They evaluate the characteristics Piaget has assigned to each of the developmental stages, extending from the appearance of language to intuitive intelligence. Within the instrument known in Bogota as the Montreal I Scale are some language items, aimed not at discovering the richness or extent of language use, as in the usual tests, but rather at exploring the level of language comprehension, including the amount of the child's representations or symbolization of words.

The items included in the so-called Montreal II Scale are directly inspired by Piaget's operative theory. Some of them are useful for children as young as four, with a range extending up to the age of twelve. Each is intended to explore one of the fundamental areas of thought, placing emphasis on the qualitative characteristics of the child's responses without consideration of time or speed. Table 2 gives a summarized description of the structure of these Scales.

TABLE 2
Montreal Scales of cognitive development (based on Piaget's theory)

Montreal I Scale		
Sub-tests	Age range	
1. Construction of a tower*	2.0 years to 3.6 years, months	
2. Use of parts of speech	2.0	3.6
3. Construction of a bridge	2.0	3.6
4. Nesting of boxes	2.0	3.0
5. Placing of rod in holes	2.6	3.6
6. Understanding of propositions	2.6	3.6
7. Insertion of blocks in a box	2.6	4.0
8. Use of hands	2.6	4.0
9. Classification of beads	2.6	4.6
10. Construction of a door	2.6	4.6
11. Judgment	2.6	5.0
12. Heterogeneous numerical correspondence	2.6	6.0
13. Articulation of fingers	3.0	5.0
14. Tracing of forms	3.0	7.0
15. Construction of stairs	3.6	6.0

Montreal II Scale		
1. Identification of objects and forms:*		
I Objects	2.0	3.6
II Forms, Series I	2.6	12.0
III Forms, Series II	3.6	12.0
2. Localization of topographic sites	3.0	12.0
3. Conservation of quantities (mass, volume and weight)	4.0	12.0
4. Notions of Right and Left	5.0	12.0
5. Concepts of causality, questionnaire of dreams	4.0	12.0
6. Concept of age	3.6	9.0
7. Class inclusion	4.0	12.0
8. Conservation of surface	4.0	12.0
9. Relation of weights	4.0	12.0
10. Floating and sinking of objects	4.0	12.0

*In both questionnaires (Montreal I and II) the names given by Piaget or by Pinard to the problems have been preserved.

Considerable effort has been necessary to adapt the original scales (Einstein, Montreal I and Montreal II) to the needs of the Bogota Project. The psychology team of the Bogota Project spent over a year on this enterprise. The main objective, were to make the items culturally congruent without losing any of the intrinsic characteristics of the instruments, to make the scales practical and feasible within the context of the Project, and to permit standardized responses.

Preliminary studies showed that the scales could be administered to children from the target area in Bogota, regardless

of class or nutritional status. The scores obtained in these tentative field trials were logical, congruent and comparable with those obtained by the researchers in Montreal and New York. The administration time, initially thought to be one of the main obstacles, has, in the Bogota version, been found to be approximately one hour for the Einstein Scale, one hour for the Montreal I and two hours for the Montreal II. Two thousand and thirty five subjects have been tested up to the present time. Approximately one half of them have been re-tested at conventional intervals. The data gathered, including information on the characteristics of the family and on nutritional status are now being analyzed. Analysis of a small sub-sample suggests that these measurements are reliable, although a definitive evaluation will have to be postponed until the analysis is completed.

The theoretical framework discussed herein and the experience gained in the Harvard-ICBF-Cornell Research Project on Malnutrition and Mental Development suggest some conclusions regarding the use of measurements of cognitive development in studying conditions of deprivation, including malnutrition:

1. The notion that malnutrition is just a limited area of the total picture of deprivation seems realistic.
2. Clinical malnutrition is a suitable parameter for the study of the general role that deprivation plays in psychopathology in underdeveloped countries.
3. The deprivatory system is a very complex and mobile one, within which malnutrition and the individual psychological status are merely areas of a very large network of interactions.
4. Assuming that malnutrition can properly be defined and recognized, and that some intervening variables may be controlled, the degree of deprivation of "general stimulatory input" will influence the scores of traditional scales of intellectual performance to the point that differential results between malnourished and normal subjects would have to be assumed to be secondary to different stimulatory influence, such as social class.
5. The evaluation of the emotional changes which accompany deprivation is important. However, the currently available instruments are not as efficient as one would desire. Every effort should be made to refine such instruments, particularly in investigations regarding nutritional status since the clinical evidence suggests that the impact of the failure to satisfy the hunger drive is enormous.
6. As far as cognitive development is concerned, it is accepted that there is an efficient framework for its understanding (Piaget's Psychological theories), and that recently there have

been successful efforts to develop psychometric instruments able to measure such development.

7. An initial assessment of scales of cognitive development carried out by the Harvard-ICBF-Cornell Research Project on Malnutrition and Mental Development has led us to believe that this approach is feasible, practical and has high theoretical power.

NOTE: This paper was made possible by a contract (PH-43-68-1512) from the National Institute of Child Health and Human Development and the U.S.-Japan Cooperative Medical Science Program with additional funds and services provided by the Division of Nutrition, Colombian Institute of Family Welfare (Direccion de Nutricion, Instituto Colombiano de Bienestar Familiar, Bogota), the Department of Nutrition, Harvard University, School of Public Health, Boston, and the Graduate School of Nutrition, Cornell University, Ithaca. The Harvard-ICBF-Cornell Study on Malnutrition and Mental Development is a cooperative venture among these three groups.

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DISCUSSANT'S COMMENTS

by

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The foregoing papers relate to ways in which we may assess the psychological development of the child and consider the manner in which the course of this development is affected by nutritional stress. In discussing them I choose the path of a developmental psychologist and seek to identify the developmental stage at which the two presentations may relate to one another. In my view their relation is tenuous and represents an early stage in the development of our art.

This stage may be related to a stage in the development of the child when he first comes into contact with other children and with shared problems. It is a stage which we call parallel play. In it the child engages in a set of activities which in substance and in spatial association are related to what other individuals of the same age are doing, but in fact does not represent a functional interaction with them on a joint consideration of a common set of issues and problems. Our present state of development, in considering the question of intellectual evaluation and assessment in relation to nutritional stress, is at this stage in its developmental course and can quite properly be viewed as a manifestation of parallel play in science.

One of the reasons for a conference such as this is to push development forward at a more rapid rate than would ordinarily be the case under uninfluenced circumstances. Hopefully these discussions can move us from a stage of parallel play into a stage of true interaction in the area of ideas as they relate to the problems under consideration.

There are at least two types of concerns which may be exhibited when approaching the problem of the relationship between nutritional history and psychological development. One path is to define whether individuals with dissimilar nutritional antecedents exhibit dissimilar courses of cognitive development. The other is a consideration of the particular mechanisms of cognitive development which may be differentially affected by

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antecedent sources of nutritional stress. These two paths which are conceptually distinct are often confused with one another. Discussions of the first point proceed in parallel with discussions of the other with the assumption that the same issues are being considered. This is not the case. The first question requires that we identify measures, omnibus or otherwise, which indeed differentiate children exposed to the conditions of risk, from children who are otherwise comparable but who have not experienced such exposure. The second is directed at an identification of the particular mechanisms of psychological organization. It is well known that the effects of stress can be selective and that certain mechanisms in behavioral development may be severely impaired while others remain relatively intact. We, therefore, can confuse ourselves in evaluating a child if we counterpose an aspect of development which has been affected with one that has been unaffected and conclude that the evidence as to whether he has been affected is confusing. If one were an orthopedist who examined a child with a clear manifestation of brachial plexus palsy, and noted his ability to kick a football and then argued that he has no disability because he could kick a football normally, his reputation would suffer. Similarly a psychologist who finds major language disturbances in a child, serious disturbances in his social functioning, but no disturbance in his arithmetic ability, would be foolish if by focusing on his arithmetic intactness he were to conclude that it was doubtful that the child had any functional disturbances. Clearly, therefore, to find both areas of intactness and of disturbances in children who have been exposed to antecedent conditions of stress is something to be expected and there is no sound basis for arguing that the evidence is confused. To come to this conclusion would be to engage in a kind of clinical nonsense having no meaning to the field and no value to the child.

To have all functions equivalently affected is a rarity rather than a rule in children who have been exposed to antecedent risk conditions. Perception may be relatively intact but language function significantly disturbed. The appropriate use of a wide ranging test battery for examining the consequences of exposure to a risk condition, therefore, is to indicate to us the particular areas of functioning which have been affected and the aspects of functions which are insensitive to the particular conditions of stress. When in follow-up studies of previously malnourished children we find certain areas that have been affected and others not, we have obtained clues as to the particular aspects of development which are sensitive to the risk conditions and not evidence which permits us to reject the finding of regions of normal functioning. Unfortunately, this

straight-forward logic has not been applied in the evaluation of findings in the area.

If we agree that certain tests will be sensitive indicators how can we select tests that will have reliability and validity? This is not a new question but is one that has concerned workers in child development from the early nineteenth century onward. From that time to the present, a number of strategies have been defined for identifying cognitive functions in children and for measuring them. In all of this work it was recognized that many variables may affect this aspect of development. Among these were the social conditions in which the child grew up, his opportunities for experience, the integrity of his nervous system, his needs, aspirations, motives and his desires.

At the risk of being pedantic, I would like to recall to you that in the 1800's a man named Itard pointed out that although his wild boy of Aveyron did not respond to certain sounds such as words or human noises uttered to him, he did respond to the cracking of a nut which was a food that he regularly ate. Itard therefore indicated that there were selectivities in the perceptions of individuals which were dependent upon important features in their adaptations to conditions of life. As a consequence, from that date to the present, workers have continuously been concerned with the degree to which the child's level of functioning has been affected not merely by a biologic condition of risk but by his habits of responsiveness and his experiences with mental operations of various kinds.

These concerns have, to a greater or lesser degree, colored the interpretations of the findings which derive from measurements of mental capacity. There is no question that they are pertinent to interpretation. However, it is equally apparent that the functional level of cognitive organization which the child manifests must first be assessed before the reasons for his functioning at the particular level can be adduced. Our first problem therefore is the problem of defining ways for measuring cognitive functioning whether the level obtained is affected by one or another mechanism.

I would like briefly to review some of the strategies for measurement that have evolved. One strategy represents a method which can be called the method of invidious comparison. Intelligence tests reflect this method. In them one seeks to define the characteristics of an individual in terms of the degree to which his performance on a set of standard demands for functioning equals, is superior to, or inferior to, that of children in an appropriate reference population. The reference population can be one that derives from his own culture, but also by one that derives from other cultures. When reference populations derive

from cultures which are different from the one to which the child being assessed belongs, it has been argued that the measure used is inappropriate. This is but a half truth. As Vernon has pointed out, it is, of course, entirely inappropriate to compare children from a population of a different kind with the members of the standard reference group. However, it is entirely appropriate to use such standard tests of competence so long as one does not make direct comparisons between the individuals who are being measured on these tests with the standardization population. The limitation, then, does not apply to the issue of making internal comparisons between stress and non-stress members of the same population with the standard measuring instrument. The only limitation on the use of such tests standardized in other cultures then is that the test is neither so easy nor so difficult as to prevent us from being able to differentiate among individuals in the population we are studying. We avoid all other errors by recognizing that it is methodologically inappropriate to attempt a direct comparison between the standardized population and the new population upon which we are focusing. Therefore one cannot say that children in underdeveloped countries who obtain low IQs have half the intelligence of children in the United States. Such a statement has no meaning. However, one can say that children in the underdeveloped country who have experienced nutritional stress perform at a lower level on the standardized sets of demands than do children in the same culture who have not experienced such insult. It does not follow that standardized tests cannot be used in new settings. One can merely say that they cannot be used inappropriately.

Can one, on the basis of the use of standardized tests, conclude that one or another developmental mechanism has been affected? I would answer this question in the negative. To define the nature of the mechanisms affected requires the development of a theoretical scheme with respect to the organization and development of behavior and its application to the populations being studied. Numerous theoretical structures for development of cognition have been advanced. These are available in the works of such investigators as Baldwin, Stern, Gesell, Binet, Werner and Piaget among others.

In exploring mechanisms by any other of these theoretical systems we define levels of organization of psychological attributes and seek to define the degree to which a variety of outcomes may be affected by their disruption. We most frequently do this by defining perceptual competences, logical competences and levels of epistemologic sophistication in the child's structure by defining the particular cognitive style which a child, at

different ages, uses in his responses to demands for cognitive work.

We may look at this issue from the point of view of a simplistic notion such as rate of response, or a more complex notion such as how does a child respond in terms of either spontaneous expansion upon the demand, or what are his patterns and methods of rejection of the task as presented to him. We can also look at the process from another point of view. The Russians have used this method. Instead of using the performance of an individual upon a given task as the measure of his ability, they have approached the problem by saying that we are better off in defining ability by first defining the level at which the individual spontaneously performs upon a given task, then exposing this individual to a standardized episode of instruction, and then retesting him on this task and defining the difference in his performance on the first and second examinations. This difference score may be viewed as a measure of the potentialities of the individual for improving performance with experience to the degree that this experience seeks to differentiate performance from ability.

Luria and Vigotsky have used this approach in their estimation of intellectual function. Other approaches to this issue have been considered in our presentations. We can, in a whole variety of situations dealing with defective children, modify the nature of the task demands so as to make what is not spontaneously available in function available under particular conditions of structure. To do this does not mean that the individual does not possess a defect. It does not mean that he is normal. It means that even in abnormal individuals, if you provide sufficient structural support, you can get improved behavioral functions.

Now, if we look at the problem from these points of view and ask ourselves what it is we wish to know with respect to the relationship of nutrition to intellectual development, we recognize that we want to move to at least three levels. One level is the general effect upon performance competencies in children as compared with other children in their community, taking as given the necessity for appropriate social, familial and other kinds of control. The second level is the level of mechanisms of disturbance and the particular points in the developmental sequence at which interference with emerging structure results in disordered outcomes. The third level is one with which we have been concerned only tangentially and this is the level at which we consider the degree to which the negative outcomes we identify with respect to particular conditions of risk are permanent changes in the child's capacity or whether they are, in fact,

modifiable by appropriate conditions of instruction, training and remediation.

If we recognize these three different levels of concern and direct our considerations toward each of them separately we can perhaps interact more effectively with one another in considering problems of the relation of nutritional stress to psychological development. To leap across levels or to engage in parallel consideration of issues at different levels is not productive. It is to engage in disjunctive rather than conjunctive activity in the consideration of a problem.

SUMMARY OF RESULTING DISCUSSION

In evaluating the findings reported in this conference the meaning of comparison by social class may be questioned. Most of the studies report gross matchings by socioeconomic level. Most of the children are reported to be from families in the lower socioeconomic strata. Does this gross matching by strata represent an adequate delineation of important social characteristics, or are there important differences within strata that must be considered to influence nutritional status, child-rearing practices, and intellectual development?

Although the McKays worked exclusively with lower status families from small neighborhoods, they found it impossible to identify well nourished children whose per capita family income was similar to that of malnourished children. In Latin America, 60 to 70% of the population are lower class. It is probably in error to assume that these families are homogenous in terms of family patterns, cognitive development, or in educational and intellectual levels. It may be that the families with less malnutrition have more drive and education and that this, in turn, is related to a higher income. In Bogota, however, the geographically stable families tended to have greater malnutrition, despite their per capita income being slightly higher. This was because the stability was related to the purchase of a home, which required a disproportionate amount of the total family income. Thus, despite a slightly higher total income, less money was available for the purchase of food. The micro-social environment which reflects these within strata differences, appears to be important in determining malnutrition, intellectual stimulation, and so on. One of the advantages of the Bogota paired sibling study is that it does, to some extent, provide for the equivalence of the micro-social environments.

Consideration must also be given to the effects of experimenter expectancy on the data. There are highly visible differences between malnourished and well nourished children. These differences range from height and weight to apathy and lack of adaptability to the testing situation. Some of the measured poorer performance of the malnourished children may be a consequence of the testers expectation that malnourished children will not perform as well as well nourished children in these situations. Clearly, all studies should be designed with this problem in mind.

Testers should have no knowledge of the child's status. Even so, certain characteristics of the malnourished child may be so different from those of the well nourished child as to make blind testing virtually impossible.

Methodological and interpretive questions are also raised by the development of measures of Piaget's theory. Piaget postulates that children pass through various stages of cognitive development in an invariant sequence. While there are modal ages for reaching a given stage of development, there is also considerable variation around the modal age. Does it make a difference, conceptually, or in the life of a child, if the child is later than his age mates on reaching one stage, if he is on schedule developmentally on reaching a later stage?

At some point it is important to know that a child has not reached an appropriate or important stage in his cognitive development. This is particularly true when the developmental lag interferes with his ability to meet certain social expectations. A child who has not achieved an appropriate stage of sensory motor development by the time he starts school may not be able to perform tasks required by the school, if the school assumes all entering children have achieved a given developmental level.

Some of the power of the Piagetian approach to young children comes from three different developmental areas: retention or memory, concepts of space, and concepts of objects. It may be that the child will lag in only one of these areas. If this proves to be the case, we would have new insights into the impact of malnutrition on specific areas of cognitive development.

The kinds of psychological performance most relevant in understanding the consequences of malnutrition are still unspecified. In part this is because malnutrition is a condition of risk which, in fact, comprises a wide variety of conditions and not a single entity. In this conference, the major focus has been on protein or protein-calorie deprivation, but the children involved also have vitamin and mineral deficiencies. Also, there are no fully agreed indices of malnutrition. Biochemical measures which are useful for the determination of present nutritional status, tend to be relatively unstable and in most instances, do not provide good historical information. The commonly used overall indices of nutritional status such as the Gomez Classification, which includes both height and weight, tend to lack the required precision. In addition, the child facing malnutrition is also subject to a series of other risks which include the consequences of low birth weight, family interaction, lack of stimulation and so on. These risks probably tend to be cumulative, but they are also interactive.

In planning for the future, perhaps the wisest course would

be to design studies which attempt to separate out the influence of various sets and combinations of these factors. It is only through specifying the expected consequences of each of the deprivations and of the way they interact that meaningful decisions about the areas to include can be made. Nonetheless, descriptive longitudinal studies do have great value. In addition to the analysis of known factors, they may reveal different combinations of variables that are equally or more important. A strategy of serendipity combined with hypothesis testing would appear to be appropriate.

The approach suggested by Kagan may be useful in specifying further differences in psychological performance due to malnutrition. It provides a theoretical approach for isolating single processes. Much of its power stems from an emphasis on changes in performance after training, rather than a static measuring of ability.

Perhaps what is needed is the creation of a small group who would be concerned with explicating theory as it relates to the effects of malnutrition. This does not imply that no useful work has been done in the past. Existing infant tests have limited predictive value across the total intellectual scale, but they are useful in determining certain developmental deficits. The Bayley Scale, for example, is useful in predicting from low scores in the first year to intellectual deficit some years later for lower class children. It has less predictive value for middle class infants or for children who are above the mean. The difficulty with many infant tests stems from their lack of good theoretical bases, although they do have some theoretical underpinnings and a good deal of pragmatic value.

Questions have been raised about the predictive value of the standard infant tests. There is, on the whole, relatively little continuity between infant test scores and later development. Yet, if they do discriminate among infants in important ways related to their functioning at that point in time, then they do have value whether or not they predict to later life. The prediction to later life assumes both a high degree of continuity in basic processes of development and a relatively constant environment or behavior which is more or less insensitive to gross variation in environment. Thus, the criterion of predictive value is extremely difficult to use. Insistence on using only measures which do have a clear predictive value would leave us insensitive to meaningful variations in infant behavior.

It is easy to become too concerned with methodological and theoretical problems. We need to face the political issues involved in decisions to conduct research. The interest of scientists in establishing the consequences of malnutrition is combined with an urgent interest in social action. Thus, it becomes necessary to bal-

ance the instinct to be theoretical and pure with the need to understand the political background and consequences of these decisions. From any point of view, it is political dynamite to declare that malnutrition is producing serious mental handicaps. On the one hand, those supporting a particular kind of social change will use such statements as part of their own political procedures. On the other hand, those interested in maintaining the status quo or introducing only modest changes, will continually question the quality of data on which the statement of the relationship is based. They will call for further study until full and definitive evidence is available.

Everyone agrees that malnutrition is bad. A demonstration of harmful specific effects on cognitive development or anything else is not necessary when pleading for programs to feed children. Since it will be a long time before all children are fed, the use of natural experiments to study the ways in which nutrition and other environmental circumstances interfere with cognitive and intellectual development is important. Present circumstances provide important opportunities to further develop our understanding of human development.

Concern with a full understanding of the impact of the total environment, including malnutrition, provides an important corrective. Political expedience is currently leading to the over-selling of the effects of malnutrition with the expectation that when malnutrition no longer exists, the problems with which it is associated will also disappear. School systems, for example, call for evidence to support their feeding programs because they believe that the evidence will demonstrate clearly that malnutrition leads to mental retardation. In fact, nutrition cannot be separated from either a total health package or the total cumulative effect of environment on the individual.

In the United States, there is a good deal of discussion about malnutrition, but an inadequate focus on the problems of hunger. Hunger implies relative deprivation and stigmatization as well as lack of sufficient intake of nutrients. Hunger may be just as, or even more, debilitating as malnutrition, but the elimination of hunger may well involve social restructuring. Because society is either unable or unwilling to deal with hunger, or with the conditions associated with its development, there has been a focus on problems of malnutrition as politically and socially expedient.

At the same time, our theories of social change lead us to be suspect of a single factor solution. Thus, there is a risk in taking the position that, even though all the evidence is not yet in, we must provide adequate nutrition for everybody. Clearly, there is value in the conduct of research on socially important problems and the support for such research clearly has political roots as

well as political consequences. Those involved in the research must take care to separate the political from the scientific uses of their findings.

IV



Meaning and Measurement of Social Functions

Social stratum and restricted life chances

F. B. Waisanen and Eugenio Fonseca T.

Modernization as a strategy in nutrition and mental development research

Alfredo Méndez D.

Discussant's comments

Constantina Saflios-Rothschild

Discussant's comments

Luis Lenero Otero

Summary of resulting discussion

SOCIAL STRATUM AND RESTRICTED LIFE CHANCES

by

F. B. Waisanen* and Eugenio Fonseca T.†

The relevance of the behavioral sciences to the issue of nutrition takes departure from the demonstrated debilitating consequences of malnutrition. Clearly, the more severe the malnourishment, the earlier it appears and the longer it lasts, the greater the actual or potential injury. With the deleterious *effects* of malnutrition established, there is need to turn theoretical and policy concern to *causes*. The relevant behavioral scientific perspective to the issue, therefore, is one that views malnutrition as a *dependent* variable, expressible in a socio-cultural context and the consequence of social processes. Remedial programs will have long-term effects to the degree that they can alter the context and influence the processes.

The purpose of the present discussion is to examine some of the contextual and processual elements that bear upon remedial possibilities. We argue that malnutrition, in a predominant degree, is a consequence of poverty, that poverty is the consequence of restricted power, and that restricted power tends to produce life styles that perpetuate the restricting circumstances and debilitating consequences.

The importance of the stratification dimension of social structure is evident enough. From Marx to Dahrendorf and from Weber to Parsons, the social scientific enterprise has maintained a continuing theoretical and empirical attention to the ranking of actors and collectives. Regrettably, this continuing scholarly attention has not produced an agreement on terms. We consider concepts like stratum, class, status, power, prestige, influence, and interest groups. Similarly, we deal, at the operational level, with single indicators like income, education, occupation, and ethnicity, and multiple measures like "Index of Social Position," "Index of Status Characteristics," "Index of Class Position," and "Index of Status Crystallization." (Lasswell, 1965)

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The conceptual fuzziness that surrounds the processes and states of social stratification provides no grounds to minimize the importance of the *idea* of stratification, an idea that focuses upon differentials in life chances. The higher the stratum of an actor, the greater his privileges and opportunities. The lower the stratum, the more restricted the life chances of the actor.

It is possible, among many other ways, to view these differentials in life chances as an interaction between economic power, political power, and wealth. Figure 1 represents this view graphically. In it, the stratification dimension is diagonal from upper left to lower right. In the highest stratum, economic and political power interact with wealth to perpetuate privilege; in the lowest stratum, low political and economic power interact with poverty to produce severe restrictions on life chances and a perpetuation of subordinate social status. The model also shows hypothesized lines of allegiance and predominant directions of social mobility. The allegiance factor is particularly relevant to political crisis, when, hypothetically, those in the middle strata (small businessmen, small landowners, civil servants, the military, etc.) will align themselves with the power elite. The mobility lines represent the hypothesis that social mobility, in aspiration or in actuality, generally moves parallel to either the economic or political dimension and rarely on the diagonal.

This framework provides, then, one "meaning" of social stratification: *viz. The degree to which an individual's life chances are restricted by lack of economic power, political power, and wealth.* (Fonseca, 1968).

Whether or not the degree of restriction in life chances represents a continuous or discrete variable in social reality is, of course, open to argument. Cuber and Reutzel, for example argue that

... we are on more sound theoretical ground as social scientists if we proceed on the assumption that the American ranking system is more accurately conceived as a continuum than as a set of discrete categories. (Cuber and Reutzel, 1954)

That may well be; but we can note, firstly, that the North American case may not provide the best base for making such an assessment. Secondly, and assuming that the ranking criteria may indeed be continuous rather than discrete, that condition does not preclude the possibility that human groups are formed and maintained upon the basis of similar values on the ranking criteria, and that life styles emerge that are characteristic of position in the hierarchy. There is, then, a social systemic quality to stratum occupancy.

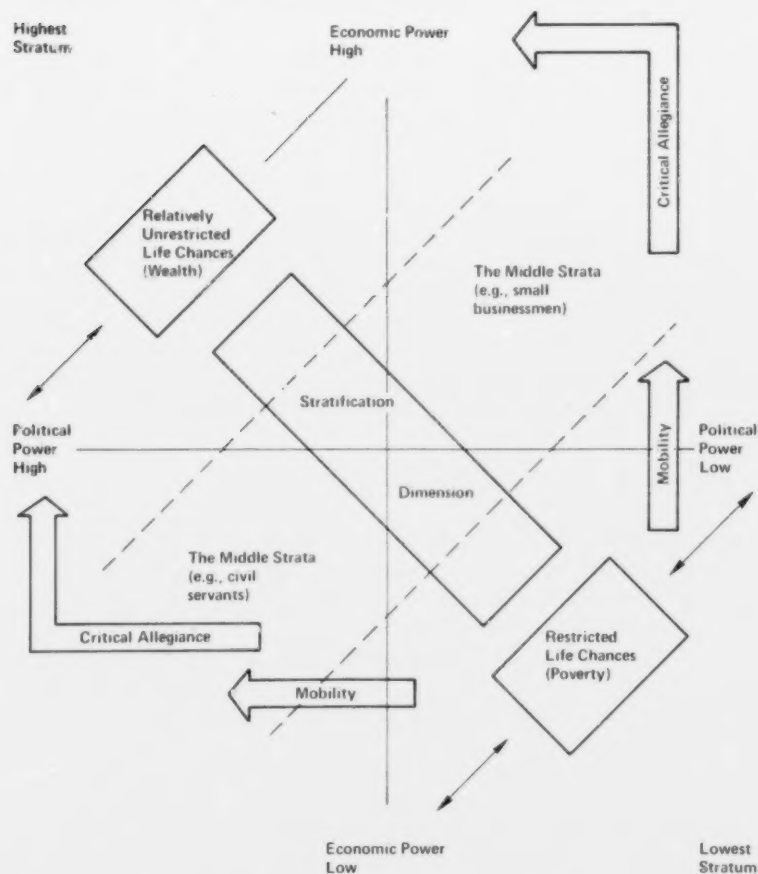


FIGURE 1. Classes and strata as functions of political & economic power.

Social Strata as Social Systems

The concept of social system is an old one in social science. In 1934, Znaniecki argued that all sciences seem to be based upon the assumption that

... reality is constituted by innumerable and various closed systems, that is, systems each of which is composed of a limited number of elements more intimately inter-related with one another than with objects that do not belong to the system, and each possessing a specific internal structure which isolates it in certain respects from external influences. (Znaniecki, 1934)

More particularly, social systems are characterized by normative boundaries, interrelationships and interdependence of

components, integrative elements manifested in common values (Kahl, 1957), identification (e.g., "class consciousness") (Centers, 1949), and intergenerational correspondence (Lipset and Bendix, 1959). The argument that social strata manifest these general social systemic characteristics has been developed elsewhere by Fonseca (1970).

For the present purpose then, we view social strata as social systems vertically ordered, in a significant degree isolated from one another, with perception of commonality within classes and diversity across classes. The relevance of these issues to human growth, social and physical, has its essential focus upon the restriction of life chances in the lower strata of society, the processes that facilitate social mobility at individual level, and the processes of structural change that increase inter-stratum contact and thus lessen the entrapment power of the lower strata.

Social Stratum and Restricted Life Chances

Social and physical growth can be viewed in an input/output balance. We invest in nutrition (input) to enable optimal physical growth (output). Similarly, we invest in education, formal or nonformal, to enable maximal social growth. Each output, then, involves cost, and people in the lowest strata of society are least able to meet these costs. They are unable to meet these costs because they are poor; and they are poor because they lack political and economic power.

It is interesting to note, however, that while maturation (as a physical growth process) and socialization (as a learning process) are complex and demanding of research attention, the latter is understandably emphasized by social scientists. Food is crucial, but the recognition of a nutritive component to food is, if not more crucial, at least more theoretically interesting.

We can, however, look at the pattern of circumstances that underlies powerlessness and restricted life chances in more particular terms. Obvious among these limiting circumstances are lack of money and lack of education; less obvious but perhaps equally crucial are restrictions based either upon individual unawareness of mobility possibilities or structurally-rooted exclusionary patterns.

1. **Income restrictions.** The first restriction to life chances, imposed essentially by low stratum, is the lack of money. If the Costa Rican laborer, as the head of the household, earns two *colones* (approximately 30 U.S. cents) an hour for a 45-hour week, he has, if all income were spent on food, about \$12.00 a week to feed a family of six members (national average).

2. *Educational restrictions.* The most efficient route to the acquisition of the coping skills necessary to effective and efficient functioning in the larger society is, beyond doubt, formal education (Inkeles and Smith, 1966; Briones and Waisanen, 1969; Waisanen, 1970).

At some critical point in the formal educational trajectory, the student comes to perceive his own autonomy, recognizes the controllability of events to maximize the chance to attain desired status, commits himself to rational decision-making, and thus comes to possess the symbol manipulative tools that are essential to social mobility. As we recognize this special force of formal education in social growth, it is quite likely that such growth does not occur in linear relationship with years of schooling. It is more likely that the relationship between formal education and modernity in behavior is critically curvilinear (Briones and Waisanen, 1969). That is, there is a convergence of forces operating in the context of schooling as a social experience that produces something like an attitudinal and behavioral "take-off" toward modernity. Data from Costa Rica and Mexico suggest that approximately five years of formal education are required to produce an impact related to the configuration of modernity. (However, data from five national probability samples suggest that the point of "take-off" may vary with level of socioeconomic development.) If five years of schooling are a minimum requirement to accelerate the individual change process, what if stratum-related restrictions enable no more than three?

3. *Restrictions on the perception of viable alternatives.* If economic restrictions lessen the likelihood of adequate educational achievement, then one who is poor and uneducated is less likely to perceive the relevance of other life styles. In other words, he is less likely to perceive the possibility and desirability of social mobility and thus can become entrapped in the structure into which he was born. He will perceive no other occupational possibility than that of his socializers; he will not perceive the instrumental value of gratification deferral—and yet, if resources barely enable survival, what is there to defer? Hunger and other deprivations do not move one to seek vitamins and protein.

4. *Restrictions re exclusion patterns in higher stratum systems.* Even if we consider the atypical individual in the lower social stratum—atypical in that he has some money above survival need, enough education to enable his perception of the possibility and desirability of mobility—there are still restrictions to his life chances rooted in the exclusion patterns of the social systems into which he would move. Social strata, because they are social systemic in nature, have boundaries that are defended against the in-

terloper; and clearly, these bounds are more difficult to break through in social ascent than in descent. Neither interest nor readiness to be upwardly mobile is enough; neither literacy nor job skills guarantee acceptance in the system of aspiration. Some stratification systems are more "closed" than others; if the walls protecting the stratum of aspiration are insurmountable, one must stay where he is and, probably, let his aspirations wither.

These observations, then, provide one framework for examining the "meaning" of social stratification. The essence of that meaning is in restricted life chances. The meaning focuses upon the consequence of vertical hierarchy, with the most urgent expression of restriction in the lowest reaches of the hierarchy. More particularly, membership in the lowest stratum means financial and educational deprivation, limited perception of alternative life styles, exclusion patterns in systems of aspiration, and, most generally, eventual resignation to the force of systemic entrapment.

The Processes at Issue

We have tended to emphasize, perhaps to over-emphasize, the self-perpetuating processes in social strata, processes that make upward mobility difficult. But mobility does occur, behavioral modes do change, and restrictions on life chances are lessened.

From a social psychological perspective, two interrelated processes touch mobility dynamics. On the one hand, there is a process of identification (or reference) with the system of primary socialization, and on the other, a process of dissociation from that system, predicated upon contact with other systems and introducing the possibility of shift in systems of reference.

Consider the individual in a low social stratum, and let the stratum have empirical setting in an urban ghetto. If the ghetto be a social system, as we see it to be, then the individual-stratum relationship can be expressed generally as the Actor in Social System A. The identification-dissociation processes then focus upon the Actor's anchorage in Social System A or shift to another social system significantly different in normative structure from A.

The differentiation of systems along normative dimensions is no simple task. For illustrative purposes, however, let's assume that Social System A (the lower stratum) is fairly characterized by ascription and collectivity orientation and Social System B (the higher stratum) is characterized by achievement and self-orientation. Then one social psychological perspective on the mobility process can be diagrammatically represented as in figure 2.

A Social Psychological Perspective on the Mobility Process

The process given diagrammatical expression in figure 2 takes departure from the relationship of (any) Actor to the social system of primary socialization (e.g., a lower social stratum). The relationship of the Actor to SS_A at Time 1 is expressed by

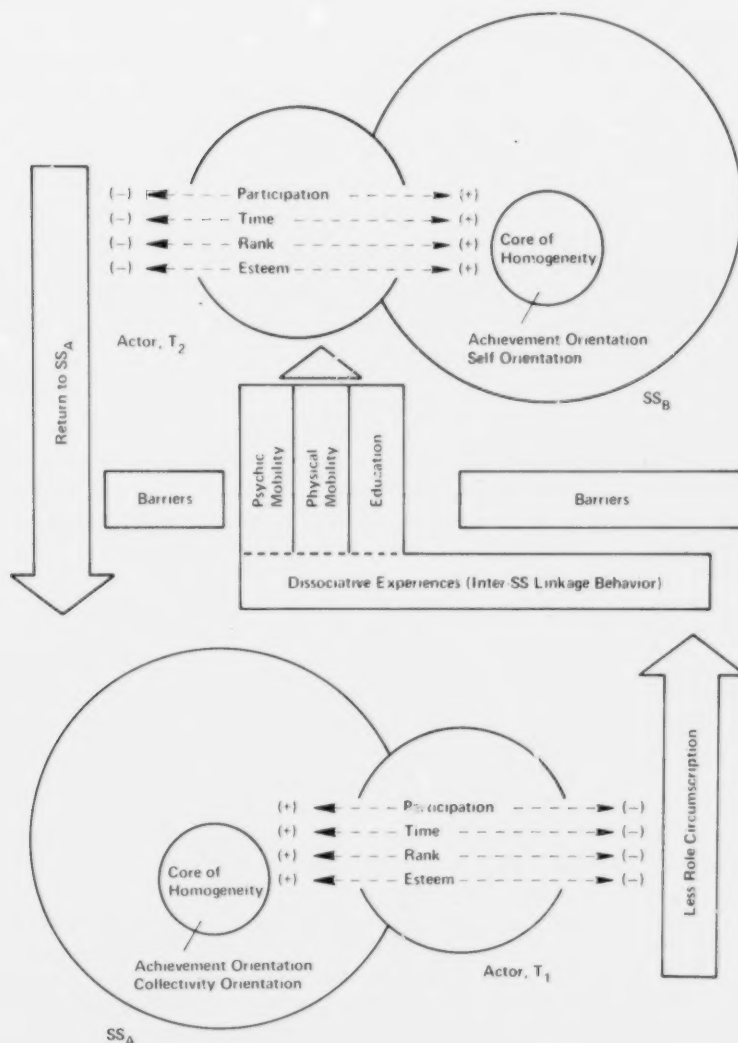


FIGURE 2. A path model of the mobility process.

four variables, two of which might be considered "input" variables (Participation and Time) and two "output" variables (Rank and Esteem). In effect, participation and time are all that an Actor can contribute to a system; rank and esteem are all that the system can give to the Actor.

PARTICIPATION

There is no single set of behaviors that would provide an adequate, cross-culturally applicable indicator of participation. Conceptually, the variable subsumes such within-system behavioral indicators as spread of interaction networks (familial, occupational, recreational, etc.), the frequency of such interaction, and its intensity. The basic notion centers around behavior oriented to the social system at issue, which represents intra-systemic role behavior. Role behavior, from one perspective, represents energy input into a social system and forms the basis for the propositions that, *ceteris paribus*, the larger the number of positions occupied (or roles played) in a social system, and the more central these roles within the positional network of the system, the greater the actor's identification with that system.

TIME

If the participation-identification relationship holds for any one point in time, then identification should increase as time-in-system increases, holding participation constant. With age as one indicator of time-in-system, we could expect, *ceteris paribus*, a positive association between age and commitment to system, and conversely, a negative correlation between age and receptivity to change.

Given distributive justice, the rewards to the Actor should be proportional to time and energy inputs. Deviations from unity in this input-output ratio (i.e., less than full distributive justice) should be viewed in a context of *relative deprivation*. For example, the comparative evaluative framework for line workers in the factory would be other line workers, not small businessmen or physicians. The present conceptualization posits *Rank* and *Esteem* as the theoretically relevant rewards or outputs.

RANK

The critical referent here is power and prestige in the system. Holding biological inheritance constant, and assuming distributive justice, expertise in system-related performance will increase with extent and time of participation. This expertise should become manifest, by example, in increased influence in de-

cision-making processes, and greater material rewards, most commonly, income. The interpretative "action" of the rank variable, particularly as it reflects leadership and related variables like influence and prestige, becomes problematical in systems undergoing significant development. In a social system that is marked by degree of conflict between modernizing and traditional forces, distinctions must be made between leadership in the two forces. Thus, the "traditional" leader of the small, isolated village in Latin America has rank that associates with commitment to the system, and he will lead the forces of resistance to new ideas. The same village, assuming some modernization has occurred, can bestow rank achieved rather than ascribed, and resting upon a basis of higher formal educational achievement, greater physical and psychic mobility. Such rank would be associated with lower identification with the traditional system and greater receptivity to change.

ESTEEM

In the present perspective, this variable has reference to the degree to which an Actor is appreciated (as an individual, and irrespective of rank) by other Actors in the system. While rank can influence esteem, the conceptual independence appears to be clear, in that esteem refers to quality of *being* rather than *performance*.

These four "Actor-in-System" variables provide the interpretative base for identification with (or commitment to) a given social system. The greater the values on the four variables, the greater the identification, and the less likelihood of change. The lower the values, the greater the probability of inter-systemic contact and the greater the possibility of change. (The notion of probability is important here. The intrusion of ecological variables into a model like the present one is substantial. For example, the amount of inter-systemic contact will be affected by the degree of isolation of a given system from other systems. A system fully isolated from others can change only by evolutionary processes.)

The Dissociative Variables

The process that can lead to cognitive and behavioral modes like those discussed above is, of course, based upon the diffusion of ideas and new practices. In the present context, we have particular interest in the diffusion of ideas and recommended practices related to nutrition and human growth, social and physical. The diffusion of such ideas (and the recommended practices that give

the ideas behavioral relevance) requires mobility. For example, a recommended nutritional practice extant in the normative structure of Social System B (with reference to figure 2) cannot diffuse to Social System A without inter-systemic contact—which requires spatial mobility, either physical or psychic.

The greater the amount of inter-systemic contact, the greater the likelihood of idea diffusion. In the specific case of social strata, the greater the inter-stratum linkage, the greater the likelihood that practices current in the higher strata will diffuse to the lower strata.

Some data from Sneden (1968) are informative and generally supportive of this model. The predominant set of variables that said most about the perception of desirability and possibility of upward mobility out of poverty enclaves of Lansing, Michigan, dealt with mobility factors, particularly measures of inter-system contact. Table 1 presents some of these data. The first five variables involve mobility-related measures.

It is interesting and informative to note that age (as a time-in-system indicator) and desire for contact with lower class secondary contacts and neighborhood visits (both within-system participation indicators) all correlate negatively with the social ascent variable. Combining both within-system and inter-system variables produced multiple correlation coefficients as high as .69. Similar findings, with various indicators of modernity as dependent measures, are reported in Roy, *et al* (1969), and Durlak (1970).

Durlak's findings come from a study of 783 heads of household in fourteen rural communities in Costa Rica. Table 2 presents correlation values between three dependent variables: 1) an individual index of modernity, 2) knowledge of recommended

TABLE 1
Partial Correlations of Various Independent Variables and Belief in the Possibility of Social Ascent*

Variable	Partial r	P
1. Contact with middle class referents	.236	.0005
2. Educational level	.234	.0005
3. General spatial mobility	.211	.0005
4. Desire for contact with middle class referents	.160	.002
5. Evaluation of middle class referents	.137	.007
6. Age	-.168	.001
7. Desire for contact with lower class secondary contacts	-.196	.0005
8. Neighborhood visits	-.137	.007

*Adapted from Sneden, Lawrence II, "Factors Involved in Upward Social Mobility from the Culture of Poverty" (Ph.D. dissertation, Department of Sociology, Michigan State University, East Lansing, Michigan, 1968), p. 57.

TABLE 2

Correlations between Inter-Systemic Contacts and Selected Aspects of Individual Modernity*

Variable	Volume of modern objects & concepts	Health knowledge	Health adoption
1. Visits to capital	.16‡	.17	.18
2. Mass media use	.23	.27	.23
3. Contacts with agricultural specialists	.14	.17	.28
4. Contact with teachers	.10	.20	.32
5. Formal education	.19	.24	.20

‡Significantly different from zero at the .01 level. All other *r*'s are significant at the .005 level.

*Adapted from Durlak, Jerome, "Role Circumscription, Communication and the Modernization Process" (Ph.D. dissertation, Department of Communication, Michigan State University, East Lansing, Michigan, 1970), p. 66.

health practices, and 3) adoption of these recommended health practices; and five independent variables, each of which is an indicator of inter-systemic contact (involving either spatial or psychic mobility). While the correlations are not strong, they are uniformly in the direction hypothesized and significant at customary levels of confidence.

The bearing of the conceptualization outlined above (including the deprivational and restrictive dimensions of low stratum life, the process of mobility, as a shift in stratum location, and the illustrative data) to human growth and its nutritive requirements is fundamental. First, structural restraints say something about the ability to obtain the necessary quantities of the right kinds of foods. Therefore, remedial programs should be addressed to structural changes. Second, upward social mobility is associated with changing cognitive and behavioral styles, moving the individual toward more rational decision-making processes, from which the recognition and meeting of nutritive needs follow. Therefore, social policy to facilitate mobility must be developed.

Some Methodological Issues in Social Stratum Measurement

The development of valid indicators for social stratum poses substantial problems even when the empirical focus is upon a single community. When research foci shift to broader boundaries, regional or national, for example, the measurement problems compound; and if research is put into a trans-national or other comparative framework, methodological problems are compounded further.

THE RELATIVITY OF STRATA AND LIFE CHANCES

It is important to keep in mind that the concepts of social stratum, restricted life chances, and social mobility are relative concepts. This crucial relativity is at issue within the strata of any single community as it is in comparisons of strata across communities.

There is no doubt that small, relatively isolated villages in Latin America, or elsewhere, will show, within their rather narrow ranges of income and education dispersion, stratification processes based upon these differences. An income equivalent to U.S. \$700 may enable the sending of one son to the nearest *collegio*; U.S. \$500 may be insufficient for the purpose. Consequently, the application of stratification criteria that would be appropriate for a large metropolitan community would be unjustified in the rural setting.

Similarly, the perception of significant social mobility has a crucial relativity based upon similar structural contexts. Intergenerational mobility from *campesino* father to school teacher son will be perceived as a vast shift. In an urban setting, the shift of the school teacher's son who becomes a lawyer may be perceived as less dramatic.

INDICATORS OF SOCIAL STRATUM

Should one use single item indicators or an index? If an index is to be used, what specific items will be combined for the purpose? While the objectives and theoretic-analytic emphases of particular research undertakings may suggest (or require) specific operational strategies, there are several problems that to greater or lesser degree must always be taken into account. Certain of these should be noted.

In the instance where a single item indicator of social stratum is warranted, should it be income, education, occupational prestige, or place of residence? To use the residential area is to assume homogeneity within the spatially-bounded strata. The use of occupational prestige requires unambiguous assignment criteria for the coding of innumerable (and continually increasing) specialized occupations. The use of education assumes both uniform quality across schools and a consistent and strong association between education achievement and other stratum indicators such as income and occupational prestige.

Perhaps the best single indicator of stratum is income. First, the income indicator is in closest conceptual fit with the diagonal stratification dimension expressed in figure 1, above. Second, income holds undeniable priority in stratum-related restrictions on life chances; it influences educational opportunities and mobility

possibilities. It affects the time available for politicking and possibilities for entrepreneurship. In times of social flux, e.g., in periods of rapid socio-economic development, income criteria may outweigh other rank assignment criteria, such as land holding or "Old Family" status.

Income provides no full resolution of the operational problems, however. Should one use the income of the head of household or the total family income? Generally, the latter. But then, should income be expressed as a ratio to number of family members? Should adjustments be made for area (and national) differences in costs of living? Clearly the family with one child, in a lower living cost area, and earning U.S. \$6000 per year is faced with fewer restrictions on life chances than the family with eight children, living in a high-cost area, and earning U.S. \$8000 per year.

In another problem context, the gathering of precise income data is made difficult by the very association of income to prestige. The wealthy may consider it in bad taste to discuss the full extent of their income. Similarly, the poor may consider it self-degrading to express the severity of their deprivation. Consequently, there is the possibility of a double bias, with high income individuals underestimating (perhaps from tax concerns as much as etiquette) and lower income individuals overestimating.

The use of indices does not enable the researcher to escape problems of measurement. Indeed, the index option must face not only the problems associated with individual indicators, but some additional ones. The crucial methodological problem in index use focuses upon the demonstration of unidimensionality. An index will be as strong (and as unidimensional) as the strength of the associations among the several items of the index. If there were perfect homogeneity in strata, then the inter-item correlations would all approach unity, and any single indicator in the set would provide equivalent specification.

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MODERNIZATION AS A STRATEGY IN NUTRITION AND MENTAL DEVELOPMENT RESEARCH

by

Alfredo Méndez D.*

The fact that man lives in societies with different cultures poses problems in the study of the relationship between nutrition and mental development. At least three strategies seem possible in such studies.

The first is to use supposedly culture-free tests for the assessment of the child's performance. In addition to raising doubts as to the comparability of the translation forms of such instruments, there is also a doubt as to whether they are reflecting the level of performance "demanded" by a given culture or sub-culture.

The second strategy uses the control of socio-cultural variables by such procedures as sampling and statistical control to arrive at an analytically culture-free individual. This is not entirely satisfactory since it presupposes an adequate knowledge of the relevance of the various socio-cultural variables, knowledge that we do not have. In view of this, although adequate research designs are of considerable help for the accumulation of knowledge about the relationship between nutrition and mental development, we should not overlook the fact that even a strict experiment leads us back to culture and society. Thus, failure to improve performance in the experimental group allows for a conclusion other than the obvious one that a nutritional improvement has no effect on mental development. The alternative conclusion is that culture and society are holding back potential. If performance improves, it would be equally reasonable to conclude that these demands or opportunities were "higher" than the actual performance of the individuals who had not fulfilled them due to their nutritional deficiencies.

It is doubtful that either of these two strategies, culture-free

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testing and variable control, could be thought of as opportunities to avoid research in the socio-cultural processes of potential relevance for mental development. In effect, the whole matter of the relationship between nutrition and mental development may be more adequately restated as the assessment of the nutritional status in its implications to the mental development needed for the fulfillment of cultural and social goals. Consequently it may be better to follow a third strategy and measure the child's performance in his "natural" environment.

There are at least three ways to do this. The first is to measure his performance in terms of the universal features of culture and society. It is reasonable to assume that these features imply specific and similar demands upon the individuals, regardless of the difference between their societies. The second is to measure it in terms of his particular society and culture. The third is to measure it in accordance with various concepts of modern society. Therefore, it is necessary to review the concept of modernization and to evaluate its usefulness as an intermediate frame.

Such a review is required because a universalistic approach may lead to several difficulties. Performance relevant to the features of all societies is of such a general nature that individual adequacy is difficult to test. These demands may need to have a character of theoretical postulates whose empirical demonstration becomes, in itself, a difficult task. An approach based on the demands of a given culture, on the contrary, lends itself to immediate research, but the results may lack the desired general significance. Modernization is relevant to the future adaptation of millions of peasants to a changing world. The frequent focus on modernization as an intervening variable or a desired outcome in studies of nutrition and mental development reinforces the need for clarifying its conceptual meaning.

Meanings of Modernization

There are several meanings of modernization: modernization as one-way acculturation; modern society as an ideal type; modernization as universal evolution, and as contemporaneous changes. A lack of conceptual clarity in these definitions has led to confusion.

In orthodox acculturation studies the locus of interest is in the processes, mechanisms, and circumstances associated with culture borrowing in a fixed period of time. The intention is to formulate generalizations about the processes of acculturation from the study of a variety of specific cases. The outcome of this borrowing is only secondary. Within the frame of modernization, on the contrary, acculturation is seen as a one-way, evolutionary flow from the "more advanced" to the "less advanced" society.

The primary concern is with the extent to which the outcome of the modernization process results in the modernizing society being an approximation of the giving culture. The process is seen as fundamentally historical and unique.

This position defines and identifies innovation, creativity and leadership as the qualities which promote the adoption of certain areas of the foreign culture. Even fields such as communication, diffusion and adoption which are not necessarily imbedded in this tradition show its influence (Deutschmann, Méndez and Herzog, 1967). Thus, there has been a neglect of important issues, including the diffusion of inner changes and of non-modern practices, and the creation of defense mechanisms which counteract the spread or negate the effects of the diffusion.

This point of view leads to gross sociological and historical misconceptions concerning the role that modern societies play in the development and support of so-called non-modern societies and the world at large. For mental development research, this narrowing of the theoretical frame of orthodox acculturation is of no particular advantage either to the evaluation of individual performance or to the use of socio-cultural variables as controls. To view innovation or adoption of non-modern traits and defense mechanisms as negative or non-existent limits our conceptions of mental functions, placing mental development research as close to an ethnocentric view as present times could tolerate. For variable control, our judgment tells us that the meaningful social segments and cultural features, whichever they may be, should be preferred to segments and features based on debatable and usually futuristically conceived approximations of a desirable foreign culture.

Unilineal evolution, as Stewart (1955) calls it, assumes a single line of development in which evolution is equated with improvement. The emphasis is on economic or economically related factors. Tools and other forms of technological change are used as the landmarks between stages. This position, however, has many inadequacies. Many societies do not fit the stages, and no convincing evidence is given for the existence of mechanisms that relate technological innovation to a particular form of social organization. The use of contemporary societies as a standard limits its theoretical value; the reliance on speculation limits credibility.

While review of the many evolutionist schemes is out of place here, it is useful to briefly discuss some of the recent ideas regarding society, the link between this and the individual, and the characteristics of modern man prevalent in this position.

Levy's (1966) definition of modernization "focuses on the sources of power and the nature of the tools used by the members of a given society." This would appear to be a deterministic posi-

tion (Childe, 1951; Cottrell, 1955; White, 1959), but is not. He overcomes determinism by stating that power and tools are used as reference measurements for practical reasons, and because they are important although not causal factors. Similarly he tries to overcome the cumbersome matter of stages by accepting a continuum "established in terms of the ratio of inanimate to animate sources of power." Nevertheless, he does not seem to sustain this position; "... question of one cutting-off point as far as the continua are concerned is absolutely vital." His characterization of the modern society approximates previously formulated ideal types. The development of a universalistic ethic attributed to the evolutionary process is of particular interest for mental development research. This frequent statement in the literature will be discussed later.

Cantril (1965) develops his evolutionary scheme from the link between the society and the individual. He relates individual aspirations to the satisfactions and gratifications offered by the society. After extensive cross-cultural research using the self-anchoring striving scale, five phases of development are established. The last and fifth phase is one of a "general satisfaction with a way of life achieved with promises of continued development." The developed countries are in this phase.

Some years after its publication, this statement creates uneasiness, exemplifying the temporary usefulness of evolutionist schemes. There are other problems. The second phase, for instance, is one of new aspirations, and the awareness of new possibilities for increasing the range or quality of satisfactions. This awakening is due to extra-systemic stimulation. Some countries, which appear to be in the fifth phase, revert to this second phase. However, countries which have actually reached the fifth phase do not revert. In case of a major crisis the people of the fifth stage countries

"... propel themselves on a self-conscious reappraisal of their assumptions and transform their reality worlds into a new patterning more appropriate in handling the transformations of circumstances." (p. 310)

It is not clear why only certain countries revert when dissatisfied. Are we to assume that there are other criteria used to assign them to the phases? These criteria would have to be found outside the theoretical frame of aspiration-satisfaction. Moreover, countries of the second phase are disturbed by others, while those of the last phase are vulnerable only to their own reappraisal of their own assumptions. Unless societies are completely isolated, they are always disturbed by others. A great deal of the reappraisal that takes place in them is likely to be related to these disturbances, and perhaps more so in the case of powerful countries.

There are several difficulties in the application of the self-anchoring scale, and in the evaluation of the results obtained. These became evident in a study in which a modified scale was used in several hundred interviews in five Guatemalan towns (Méndez and Waisanen, mimeo). These, and other difficulties, make it doubtful that evolutionist schemes can be usefully used as the basis for the sorting of cultural variables in mental development research. It is likely, however, that modified forms of the scale could be used to sort some of them within a confined cultural area.

Urbanism, literacy, mass media, and electoral participation define modern society according to Lerner (1958). These qualities promote empathy in modern man: a "... high capacity for identification with new aspects of his environment" and "... the capacity to see oneself in the other fellow's situation." Each one of these characteristics of society represents a phase. Thus urbanism is prior and basic to the others, but at the present time earlier stages can be skipped with a consequent development away from the modern society. The matter of identical universal development is therefore avoided.

While three of the characteristics are evidently features of modern societies, political participation as a distinguishing criterium, and the role of all four in raising empathy are debatable. Thus, when Lerner states that traditional man has habitually regarded public matters as none of his business, he violates factual evidence. When he describes political participation in modern society he confuses ideology with fact:

"In a century that has reinstated revolution as a method of social change, they (the modern societies) have managed to adapt their own accelerated growth mainly by nonviolent procedures." (p. 64)

His conclusion presupposes a detailed comparison of such things as number of city blocks burned or political murders in modern and non-modern societies. It seems reasonable to think that whether one or the other kind of society would compare favorably would depend upon a particular historical moment.

It is legitimate to question whether mass media necessarily raises empathy. The same question may be asked about literacy. There is no reason to believe that certain social structures within the urban situation will be less favorable to the development of empathy than certain tribal organizations.

The most serious doubts about Lerner's work concern his concept of empathy. Is empathy a characteristic developed or maximized by modern man, or a mechanism indispensable for any social living? The question cannot be answered without further analysis. If empathy is measured in terms of the number of positions with which the individual can become identified, primitive

men and peasants would have little empathy, and its degree would be affected by the size of the group and the prevalence of the exterior contacts. If, on the contrary, empathy is measured in terms of adequacy or completeness of identification within the relevant social group, then empathy may be very high among primitive men and peasants. It is only after distinguishing range, completeness, and relevant social group, and placing empathy as a universal feature, that its usefulness becomes evident for mental development research.

Whatever future contribution evolutionism makes to general sociological theory will have to come from a position that has overcome historical ignorance, speculation, and ethnocentrism. For mental development research it is sufficient to repeat Levy's words, making them general for many of the works in this line of thought. He says that his work is not a description of facts, nor a theory about facts, but rather a series of hypotheses about facts without empirical demonstration. Great care should be taken, then, not to confuse them with facts ready to be incorporated into nutrition and mental development research.

Modern society, as an ideal type, is a configuration of congruent traits whose existence in real life is somewhat irrelevant. Ideal types have been formulated in the past with an emphasis on the cognitive (Sorokin, 1937) and non-cognitive (Benedict, 1934) aspects of value orientations, the quality of social relations (Tonies, 1957), the degree of status proliferation and the quality of their structural link (Durkheim, 1933), or in terms of equal emphasis on all three aspects (Redfield, 1941).

Whatever the "logic" of the congruence may be, it should be clear that it should not be thought of as having the character of the unviolability of a natural order of things. The features used to characterize the types are choices within a variety of possibilities. In effect, the value of the ideal type as an analytical instrument lies in the possibility of detection and explanation of the departures from it exhibited by actual societies. It is a serious mistake to confuse the ideal type with an actual society; a matter of little importance when, in addition, it is confused with the ideal society, and with an obligatory stage in an evolutionary scheme.

Societies are in continuous change. The recent ones are usually well documented in countries where there is a tradition of social research. This is the case of the American family (Burgess, 1945; Mead, 1968; Parsons, 1942; Winch, 1963). But, a better documentation does not obliterate the fact that in a given period of time, there are as many modern families as societies. There is reason to believe that in the past, as well as in the present, there were adults for whom things were not the same as "in the good old days."

Moreover, societies are generally thought to generate change by themselves without having to be exposed to external contacts. Change does not occur only as imitation, or due to the same factors that alter our own society. Whether one sees change predominantly as "inner" or as due to extra-systemic influences depends to a great extent upon whether one is "in" or "out" of a particular society.

The study of the internal processes of institutions, such as the family, could be converted into a powerful instrument for understanding such issues as tensions between individuals and between positions, the mechanisms for alleviating these tensions, the views of the family group from different states, and so on. All of them are of considerable relevance in the child's socialization and, consequently, for his mental development. It is difficult to conceive that an equal understanding could be achieved by an outer view, and certainly not by evolutionistic schemes.

History shows that societies achieve full development of their culture patterns at certain historical periods. Thus Kroeber (1944) talks about culture climaxes, and Hagen (1962) of traditional and innovational societies. The latter states:

"Traditionalism, it is clear, is a state that may characterize any society. Its presence or absence distinguishes two states of a given society, rather than setting one society apart from others." (p. 58)

Thus modern societies are in an innovational state which may be superseded by new traditionalism.

The elite, traders, and peasants, components of the traditional society, have their own world view and personality which resembles Redfield's (1956) concepts of "little" and "great" tradition. The emergence of the innovational state is possible through the struggle to achieve or maintain power among the elite. The predominant feature of the innovational personality is creativity. Creativity is defined as a complex of characteristics, including: the perception of phenomena as forming explainable systems; the existence of creative imagination, confidence and contentment in one's evaluations; satisfaction in facing and attacking problems and in solving confusion and inconsistency; together with a sense of duty and responsibility to achieve, intelligence, energy, and the knowledge that the world is threatening.

The conception of modern society as a stage or a state is a distinction which should not be taken lightly. The first view leads to a man who is modern to the extent that he resembles us in the content of his culture, in his efficiency in handling our world, and in his general social genesis. The second view leads to a modern man who may not resemble us in an obvious way, but who may show certain qualities which are found in some members of soci-

eties in an innovational state. Thus, we can talk as legitimately of primitive intellectuals and savant peasants as we can of great men in our own cultural tradition. For mental development research, these are the qualities and behaviors of primary importance, and an effort should be made not to confuse them with the first ones.

Modernization as Strategy

The previous discussion leads to the conclusion that there should be considerable caution in the use of modernization and related concepts when applied to mental development research. Moreover, it is doubtful that modernization can lead us to the advantageous position of an intermediate strategy between a culturally universal approach and one bound to the particulars of a given culture.

A summary assessment of the concepts reviewed indicates that modernization as acculturation and universal evolution is debatable in terms of wider sociological theory and factual evidence, and of little use for mental development research. The usefulness of the ideal social type is not readily evident. Modernization as recent change, in a given society, is an important area for consideration, but does not constitute a breach between universalistic and particularistic approaches. In the present stage of knowledge its usefulness lies precisely in the understanding of particular cultures. Finally, by viewing modernization as a configuration of change, it may be possible to generate an intermediate approach in the future. Unfortunately, a great deal of clarification of concepts, research, and basic theory is still needed. The modernization approaches have, however, brought to the fore important issues that can profitably be incorporated into current mental development research. These contributions are related to the measurement of the child's performance, and to the control of socio-cultural variables.

Measurement of the Child's Performance

Some of the characteristics attributed to modern man are likely to be universal features derived from participation in any social group. These features may be used to measure mental development. This is the case of empathy, a mechanism needed to play "the social game." It is by seeing "oneself in another fellow's situation" that the child is able, at least in part, to predict alter's behavior as it is known to humans, to evaluate role performance, to learn the social rules and values, and to make true social innovations.

The need for distinguishing between range and completeness of empathy is essential. Both range and completeness are likely to be culturally defined according to the size of the group, the degree and nature of exterior contacts, and structural features of the society. Within these limits the growing child expands his range, and consolidates the completeness of his empathy. Consequently, it is a priority task to trace the natural history of this expansion of range and completeness in order to compare well and malnourished children within a cultural area.

The child's empathy range depends on social groups to which empathy is expanded and not merely the number of individuals or stati covered. Thus, the malnourished child's empathy may be limited to the large family context while that of a well-nourished child the same age may cover other groups as well. The sequence in which empathy extends—family, church, government, etc.—may also be relevant for his mental development and behavior. Similar considerations should be made for empathy completeness.

The development of empathy presupposes an association of stimulus and response across a time lapse; the equation and differentiation of varied behavioral patterns; the equation and differentiation of individuals according to stati and roles; and an adequate perception of different levels of complexity of the interaction system. Thus, the study of the adequacy of the child's empathy in its predictive function could include such fields as the adequacy of his prediction of:

Alter's response at different distances between stimulus and response;

Alter's response at different degrees of similarity to ego's behavior with respect to a prelearned prediction set;

Alter's behavioral variations in response to particular ego's behavior.

His adequacy to predict from stati similarities, could be studied by his adequacy to predict:

Alter's behavior toward others in ego's class;

Alter's behavior toward others in a different class than ego;

The behavior of others in alter's class toward ego;

The behavior of others in alter's class toward others in ego's class;

The behavior of others in alter's class toward others in alter's class.

His predictive adequacy in dyads, triads, and multiple interaction systems may be an important dimension of the development of his empathic capacity.

The development of non-predictive aspects of empathy could include similar fields: the development of judgments about other people's behavior when elicited in reaction to ego, ego's class, al-

ter's class, and other situations similar to those described above. The capacity to imagine alternative ways of acting can also be investigated in accordance to this or similar schemes. The concept of creativity is intriguing because of its possibilities for serving as a linkage between nutrition and cultural climaxes. But its definition embraces too many aspects which make its operationalization difficult. Whatever name may be given to the general function, a further definition of the various aspects seems desirable.

Of particular interest is the creativity that the child may show when imagining, foreseeing, or eliciting behavioral alternatives in social relations. This behavior is likely to be related to empathy, identification, and the general conceptual knowledge of the social system. The investigation of the child's creativity in this area implies some difficulties. Some forms may be due to inadequate empathy and general knowledge of the social system, while others may be due precisely to the opposite. While the development of techniques to differentiate both cases may prove difficult, the assessment of the child's true social creativity, derived from adequate knowledge, calls for a prior assessment of this knowledge. The evaluation of his empathy capacity, could be but one step in this assessment.

These two types of creativity may be best exemplified by reference to the marbles game. When Piaget (1962) discusses young infants' violations of the rules of the marbles game by *ad hoc*, temporal, and individualistic rules, we are facing creativity by ignorance, and a non-developed moral judgment. Piaget does not fully explore violations of the rules resulting from the boredom of having mastered them, or the desire to explore new alternatives. The functions of these violations also impinge upon the distinction, because the violations may serve to consolidate a thorough knowledge of the "true" rules by creating contrasting situations.

Status and role differentiation has been considered a universal process (Parsons, 1967). In the opinion of this writer any politically, economically, or demographically expanding society proliferates its *stati* and roles. However, whether this proliferation is seen as a long-term gain in social history, or a burst away from the traditional, or stable society, the fact remains that the *stati* are modified in number, in the behavioral patterns associated with them, and in their link with other *stati*. This may permit one to postulate the existence of a universal "demand" on all individuals for flexibility in their interactions in an always changing situation, and for the creativity associated with this process of change.

The child may show creativity in establishing new rules, or in imagining, foreseeing, or eliciting alternative behavior. He

may also show creativity in social categorization, of which the stati are a specific case. The child's creativity in social categorization may be related to his analytical capacity. An objection biased by some modernization schemes may be raised here about the possible exclusion of the mental act of collapsing categories from a designation of creativity. The child's leaning toward a proliferation or a reduction of social categories may be an expression of his value orientation. His preference may be related to "conservative" or "liberal" attitudes, or to the general mood of his society. His imaginative capacity for one or the other probably is one adequate index of his social creativity. Here again it is necessary to distinguish between creativities at different levels of knowledge. Thus, pilot studies in rural Guatemala (Méndez, unpublished) have shown that small school children do classify individuals and activities in stati in an heterodox way, but this has been attributed to a tendency toward specificity associated with an inadequate knowledge of some general features that characterize the classification of a given position by older children. It is doubtful that research on the various aspects of social creativity could be conducted with very small children, but a variety of aspects can be investigated with older malnourished children and with older children who have recuperated from early malnutrition.

Morality and its development are aspects which also could be examined as universal social features. Here again it is necessary to draw certain distinctions. The universalistic ethic attributed to modern man may imply primarily the application of a given set of rules to the totality of a population. This is Levy's implication when claiming that the truth of Greek democracy has been exaggerated, as in ancient Greece, a non-modern society, democracy was only for the citizen, and not for the total population. It is interesting to notice how many minority groups of "modern" societies have been forgotten in this reasoning. On the other hand, a universalistic ethic may imply an autonomous morality, as opposed to heteronomy in Piaget's sense. Although its genesis is mutual respect, there are no implications as to the size of the group in which this respect operates, and consequently, as to the population to which the rule applies.

Assuming that Piaget's theories are adequate, it is unlikely that the use of the fixed stages of moral development he establishes would be the most useful procedure to apply in mental development research at this moment. A preferable procedure, taking into account Piaget's own cautious statements as to the analytical and expository value of the stages, would be to record and analyze the child's behavior and thoughts related to strategically conceived social interaction sets within a given culture. By this procedure it would be possible not only to account for cultural

variations, but also to discover differences in the sequence that a given level of moral development is reached in these interaction sets among well and malnourished children. While groups of these children may not show differences in their average thought and behavior, as measured by one or more interaction sets, well-nourished children may, for instance, reach higher levels of moral judgment in those sets with a more complex set of rules, in interaction sets beyond the primary group or groups larger than dyads.

Some other concepts do not refer to universal features. Success is one of these. It is unrealistic to assume that success is a prerequisite for social living in the same way as empathy and morality unless it signifies survival, and therefore becomes trivial for mental development research. The initial means at ego's disposal, the compatibility of the individual's biological makeup with his culture, and entirely circumstantial issues, play an important part in success. It is also unrealistic to assume that mental development could be assessed by success in the same way as by creativity. Success presupposes a struggle against other members of the social group, making possible a relative scale in a way that creativity does not.

The same could be said of adaptation. In fact, the child with an excellent knowledge of his social system, with creative capacity, and otherwise good mental development, may be, because of it, an alienated person. He also may be an unsuccessful competitor, and a non-adapted individual if, for no other reason, than having been eliminated and frustrated by another able rival.

"Need achievement" (McClelland, 1961) also creates difficulties in measuring mental development. The child, in order to function within the social system, has to have the necessary "push" and "know how" to obtain what he desires. But "need achievement" is a special kind of motive, based on goal preference, and not the universal prerequisites of social living. It may be said to be the need to achieve achievement.

For mental development research, it is the general function which is of primary interest. Because of this, adequate techniques should be devised to measure the clarity with which the child is able to perceive goals, and the complexity and prevalence of his strategies while controlling for the intensity of his motivation and other attitudinal variables.

Although these aspects have not been absent in nutritional research, little attention has been given to them in relation to social goals, principally those with a character of affiliation. This is probably due to a tendency to see these goals in terms of nonintellectual behavior. We should realize, however, that for most children, obtaining affection, recognition, or embedment into social

groups are likely to be perceived as difficult and important tasks for which certain strategies should be developed. Affiliation, therefore, does not presuppose passivity, and does imply certain intellectual functions. In this context, the distinction between "need affiliation" and "need achievement" also becomes blurred. Affiliation can be achievement in the same way that striving to achieve can be a search for affiliation. There is, consequently, a need for a greater effort to measure the child's thought-behavioral complexes, and his use of his social system associated with the attaining of social goals as functions of his mental development, regardless of whether his ultimate purpose is affiliation or achievement. It is possible that the distinction between affiliation and achievement could be used profitably as part of a provisional frame for classifying the kinds of strategies the child uses, rather than his motives or goals.

Variables Controlled

Modernization studies have brought to the fore attitudinal variables such as value of time, change orientation, aspiration levels, ability to abstract and perception of life conditions, which could be used profitably to establish meaningful social segments for purposes of variable control (Méndez and Waisanen, mimeo), although much basic research remains to be done.

In order to assess the effect of nutrition on mental development, whether or not a social approach is adopted, it is necessary to know the effect of socialization on the child's performance. The most general assumption in this field is, of course, that the ways in which the members of the family handle the child relate to how the child, and the adult, will perform. Two positions can be mentioned. The first emphasizes the family as a causative factor. Individual behavior is "explained"—although not necessarily completely—by the family socialization practices. The second position states that the way the family handles the child is congruent with the social system or a general cultural pattern. In the first case, individual behavior is "explained" by socialization practices; in the second case, the process of socialization is "explained" in terms of configurational congruence.

When socialization practices are considered as causative factors, other assumptions are made. One of these is that like produces like, thus traditional parents produce traditional children, Calvinistic parents, Calvinistic children. Such a position allows for continuity, but not for change. From social history, and daily experience, we know that hawks can come from doves. In most cases socialization, at best, only explains the easier side of the problem: children resemble parents.

Another way of handling the matter is by corresponding characteristics. Reference is made to binal categories: authoritarian parenthood—responsible but not individualistic or creative child. This child becomes an authoritarian parent, who again produces a responsible child.

It is difficult, however, to explain why innovative individuals can come from the most authoritarian families, and from those segments of society in which kinship relations are predominant. It is equally difficult to explain why apathetic individuals can come from Calvinistic parents. There are two alternative conclusions; one is to deny the universal validity of the family types developed and of the preponderance of kinship as factors producing lack of individualism, creativity, and innovation. The second alternative is to find a mechanism to explain changes from one generation to another, at the same time accounting for continuity.

Extensive works on change mechanisms, other than those of historical nature, are not frequent. Some of the mechanisms proposed are difficult to take seriously. McClelland, for instance, states that a shift away from the authoritarian family can be achieved by removal of the principal depressing "need achievement" factor, the authoritarian father and that this could be achieved by killing some of them off in a war, by changing the definitions of their roles, or by promoting a merchant marine.

Clearly, McClelland's mechanism lacks theoretical depth and factual support. All over the world, countries are changing. Feminism has frequently been associated with the fall of great countries. Rome was full of the Senecas from backward countries, and many of the modern entrepreneurs did not travel as children—certainly not as children without their homeland authoritarian fathers—to the developed countries.

In the absence of well-proven mechanisms for change and, to a certain degree, for continuity, it would seem unwise to adopt ready-made family typologies as means to control variables for a later measurement of the impact of nutrition on mental development. It is my contention that the typology used in such studies should be based on an intensive study of the family in the localities in which the research is to be conducted. Such typology should cover the ideological aspects of the family, its structural features, and its socialization practices. Ideological aspects are understood, amongst others, as education and aspirational levels, the level of cognition of the social system of the socialization agents, their world view, their conceptions of their family and other families. Family structure refers primarily to the distribution of power and affection, and socialization practices to such matters as timing, content, means and agent associated with family teachings. Historical knowledge about recent changes in the

families of those localities, and the commentaries elicited about them, may also be an asset in the understanding of the family.

The use of "native" family types permits one to compare child performance without the need to acknowledge or dismiss the hypothesis that like produces like. If the types are adequate, they will have a predictive value. Modal families will produce modal children, whether they are similar, "corresponding," or contradictory to the parent's model. Whether the outcome of the socialization process is due to nutritional factors influencing success or lack of success in fulfilling social demands, or to a non-understood social change mechanism, could not be determined at this time. Intensive knowledge of the family and of the nutritional status of the child, should permit one, however, to draw tentative conclusions. Children from modal families who deviate from other modal children should show either better or worse nutritional status in accordance with their performance.

In conclusion, I would suggest a research strategy which centers on the child as a social individual; techniques should be developed to observe him systematically in his natural environment, and to investigate those aspects of greater importance in his social behavior when observation is made under natural or laboratory conditions. One should use universal requirements of social living as dimensions for mental development evaluation; emphasis should be placed on aspects such as the development of the child's predictive capacity, moral judgment, social creativity, general knowledge of his social system, and the nature and complexity of the strategies he devises for the attainment of his goals. The final point in this strategy would be to use a family typology based on actual local research as one of the means to control social variables.

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DISCUSSANT'S COMMENTS

by

Constantina Safilios-Rothschild*

In considering Dr. Waisanen's paper, I wish to make a comment on the role that formal education can play in increasing the life chances of people in the lower social strata. In some countries, having four or five years of education does not really increase life chances very much, and may actually decrease them. At times, the experience of having learned a few basic things about health, nutrition, or family planning, because of the immediate relevancy of such information for their life may increase life chances more than five or six years of formal education. In certain areas of the world, the lack of employment opportunities for those who have a relatively high level of education (sometimes even college education), indicates that their education does not significantly improve their life chances. Much of the brain drain can be explained by the fact that many well-educated people in developing countries have few life chances in their own country.

Let me turn now to questions of modernity or modernization. Modernization may be the more appropriate term, since it implies a process, while modernity implies looking at the modernization process at a particular point. I think a distinction should be made in terms of the type of modernity one is concerned with. One such distinction may be made between individual or social-psychological modernity, and social-structural modernity. We do find a good correlation between the level of education and the individual's modern or less modern attitude and behavior. However, if we look at the social structural situation, we find that it is unrelated to education.

In the developing countries there are people who are modern in terms of their individual attitudes, desires, and aspirations, but who cannot behave in modern ways because the social structure does not permit them to do so. In addition, there is not a good correlation between the level of economic-industrial development of a country and the percentage of people who are modern in terms

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of their social-psychological perspectives. People who have developed modern perspectives, in countries where social structural arrangements do not permit them to act on these perspectives, are apt to migrate to countries that do have a better agreement between the social and individual level of modernity.

I agree with Dr. Méndez that the evolutionary definitions of modernity are not particularly useful because they most often tend to be ethnocentric and assume that there is only one way in which people can be modern. They usually assume that the way middle-class North Americans behave represents the ideal towards which everyone must move, if they are not to be doomed to traditional patterns all their lives.

It is difficult to define modernity in ways that are cross-culturally applicable. It appears promising to assume that modernity is neither unidirectional—towards the American middle-class pattern—nor unidimensional. When you look at the social psychological or individual level, modernity has a number of dimensions, which so far have not been well delineated. Additionally, both individuals and societies can be very modern in some respects, and very traditional in others. For example, I have been rather struck by the American intellectual, liberal man who is very liberal and “modern” on social issues such as race or poverty, but very traditional on the issue of women.

In terms of societal modernity, you can have societies that permit some kinds of mobility or options that are open to people in all categorical memberships (men, women, Jews, Protestants, blacks, whites), but which do not permit other kinds of choices. This is not necessarily a consistent or unidimensional concept. In this sense, I define societal modernity as the degree to which a society is successful in removing social and structural constraints and in establishing the appropriate compensatory mechanisms so that all individuals, regardless of their categorical membership of race, class, sex, age, religion, and so on, can have equal access to a wide range of options in all life sectors.

I define as individual modernity the degree to which an individual is aware of the range of available options and the degree to which he holds values that permit him to choose whatever option is best suited to his ability, style, skills, interests and performances, rather than according to his categorical memberships. This definition implies that there is no particular way or no particular option that one must take in order to be modern. This is in contrast to most conceptualizations of modernity, which assume that there are right and desirable choices that one must make. Likewise, I think that modern society is one which permits a wide range of options. While some of these options may be regarded by many as traditional, they may be a better fit for some individuals.

Social modernity does not necessarily correlate well with the level of social or economic development of a country. Hence, some highly industrialized societies may not be the most modern in terms of the kinds of options they give most people. Even societies with a high social mobility may not be modern unless the degree of social mobility is equal for people in different categorical memberships. If social mobility exists for only limited categories, I would not call the society modern.

Of course, the consequences of opening options to underprivileged groups is still an empirical question. If, for example, lower-class people achieve access to more options in some life sectors, will middle-class people have fewer options in the same life sectors? Will this restrict the availability of their options? It will depend on the degree or type of accommodation that society makes for guaranteeing a balance between being able to open up options for underprivileged groups, and not seriously restricting the options of the traditionally privileged groups.

Finally, let me ask this question. Why should people who are concerned with nutrition studies be interested in family modernity? The easiest way is to be interested in the individual level of modernity, in seeing what particular characteristics of parents specifically relate to malnutrition of children. However, this does not cover all the important variables. There has, so far, been a striking absence of variables concerned with family dynamics in all nutritional (but also sociological) studies. Even when reference has been made to the family, the concern was with the family composition, or size, or other structural variables. I do not see how you can have any real understanding of the significant variables that lead to malnutrition, unless you have a concern with variables related to family dynamics, despite the fact that they are complicated and difficult to operationalize and measure.

At the same time, we should be concerned with social modernity in terms of the social structures that must or can be changed, if the problem of malnutrition is to be solved. For the solution is not simply the provision of food. Intervention programs must attempt to cope with the basic problems of parents and children, the symptom of which is malnutrition. Furthermore, such programs must aim at increasing the parents' level of modernity, as well as the societal level of modernity, so as to enable parents to eventually cope effectively with the nutritional needs of their children and of themselves.

DISCUSSANT'S COMMENTS

by

Luis Lenero Otero*

Initially, I will comment on the role of the sociologist in studies of nutrition and mental development, with special reference to problems of applied social action in the Latin American experience. I assume that the sociologist is not an expert in nutrition. His first contribution would be to provide an analysis of the macrosocial environment as it relates to the problems and complexities of social change. Without this perspective, it is difficult to equate problems, instruments, or tests of mental development to nutritional status in countries undergoing a rapid process of social change.

A second function is the identification of social units and variables associated with nutritional status or mental development. I think it is accurate to view these interrelated social factors as independent rather than causal variables related to nutrition and cognitive development. The task, then, is to distinguish social or individual typologies which can be manipulated to aid world nutrition and human development.

The third function of the sociological approach is an evaluation of public or private programs in these fields. These evaluations are important in their own right, and as the basis for social and political strategies which must be developed if the real problems of underdevelopment and social change are to be faced.

Two principal approaches to social change can be identified in contemporary Latin American sociology. Both positions involve several ideological, theoretical, and methodological positions, but are distinguishable into the two main positions.

The first position is structural. It is oriented to an analysis of the logical functions of the different social systems within a society. It is useful in stable situations where institutions are permanent and social change is slow.

The second position is less methodologically neat, and sometimes less empirical. It concentrates on the use of the phenomena of social change, confrontation, and social conflict for the under-

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standing of social relationships. It is this more historical approach to these situations which is currently of most interest to Latin American sociologists. It often involves an ideological, radical, and politically strong, dialectic analysis of social phenomena. A knowledge of this position is important to understanding what is happening in Latin American countries.

The topics analyzed in the two papers presented in this session are both important. Méndez quite properly criticizes the unilateral theories of modernization, and presents an idea of the multiple approach to the concept of modernization. He emphasizes the necessity of both a universalistic and a more particularistic perspective for understanding modernization. Waisanen and Fonseca discuss other important issues, mentioned several times as the *leit motiv* of this conference—social stratification, including social mobility. They clarify the fact that social stratification is not a static in society. I would like to underline some of the propositions of this paper, and make some additional comments.

Waisanen and Fonseca discuss stratification rather than social class, thus introducing a distinction which is important for practical as well as academic purposes. Social class is a classical concept in European and North American sociology. However, it does not have the same meaning in contemporary society, or in developing countries, as it had during its development during the last century in Europe. Specific indicators of participation in a multiple social stratification system must be utilized in comparative studies to understand the ways in which individual and family situations are related to nutrition or mental development. The use of multiple indices of social stratification provide a more sophisticated view of the total population. For example, individuals and families may have the same level of income. Differences in education, self perception of status, social roles, occupations, consciousness of class participation, and of course, life chances, can be developed into indices of social stratification. Some of these indices will be related to nutrition, and some will not. Some will be related to mental development, and others will not. Criticisms of the use of single indicators of social stratification, (such as income, education, or occupation) are well taken. The problem then, is to move on to the development of valid indices which will be useful in discriminating different individuals in different situations.

In addition to social stratification, a number of other social variables must be taken into account in attempting to understand nutrition and mental development. Somewhat speculatively, I will discuss some which may be particularly relevant to the topic of this conference.

The social infrastructure, such as geographic elements, pro-

vides the products of basic nutrition. Particularly in rural areas, where food is taken from the land, conditions of climate, humidity, topography, and geography are of considerable importance. It is also important to distinguish natural regions, because of cultural differences from region to region. Within a region, various cultures may exist. For example, in Mexico, we have three cultures within a given region. We have Indians, traditional agricultural communities, and sometimes within a few kilometers, great industrialized cities. Within a given region, one program may be good for one cultural group but not for the others. A full understanding of the situation requires the ability to interpret the nature of each of the cultures involved.

Within these units of region and cultural group, there must be an understanding of the culture and of the character of smaller sets, since the response may differ by sub-set. Mexico has a number of geographically and culturally different regions; within each region are a number of small Indian cultures. Social change cannot be developed without an understanding of the nature of these sub-sets. Comparative studies of these sub-cultures are also necessary in order to understand the process of modernization.

Demographic and ecological dimensions must also be considered. Fertility rates play an important role in nutritional status, particularly under life conditions where the birth of one more child results in a decrease in the food available for each person in the family. We have a proverb in Spanish, "Comeremos mas, aunque comamos menos." This means that the reality of fertility is related to problems of malnutrition. It is also related to ideas of the quality of human development. This is really a North American concept; the South American is more concerned with the quantity of children, since many men consider their importance to be derived from the number of children they have. This self concept of importance is connected to nutritional problems and must be considered in program development or evaluation.

Migration is another phenomena which must be considered in this context. We have a high rate of migration from rural to urban areas, but our experience with urbanization is not the same as that of Europe or the United States. We have a new urbanization with new kinds of problems. The social relationships which migrants bring with them tend to persist in the urban areas, or to develop into new collective forms. These within-group relationships must be taken into account in the development or evaluation of programs. While the traditional indices of age or education or sex do provide some useful information, they do not provide an understanding of the nature of these within-group relationships.

Large scale organizations also have an influence which can,

at times, be mobilized for change. For example, in Mexico we have a massive organization, the Ligas Agrarias. But, the people who participate in the organization tend to be passive. All acceptance of innovation stems from its acceptance by the leadership. Hence, it becomes important to understand the structure of the organization and the nature and process of the influence that the leader has over the members of the organization.

Mass communication and public opinion may determine the success or failure of a program. Public opinion originates in a community base, but without much organization. For example, one of the reasons Mexicans are not very accepting of family planning programs stems from their perception that it is being fostered by the Government of the United States. It is important to our people to stand up face-to-face to the United States, and to be able to say that we did not follow the policy that they wanted for us.

Food habits will interfere with the ability to improve nutrition through a change in diet. Regional variations in food habits tend to be integrated with other aspects of life, and lead to a rejection of dietary suggestions intended to improve nutrition. However, different types of traditional foods might be accepted.

Successful change depends on a sensitivity to all these factors. Change must be integrated into the ongoing way of life, as this way of life is related to region and culture and to the sensitivities and habits of the various communities.

A knowledge of these factors will, however, be insufficient. Social class and political structure must also be considered. In Latin America the class structure is different from that discussed in most sociological works. We have a double society, with a small group at the top having the same life style as the industrialized countries, and a large group at the bottom where marginal differences are extremely important in determining life chances. Better workers do have a better chance, even under extremely restricted life conditions. Both the high degree of restriction and the marginal differentiations are important.

From this perspective, we must consider the influences of governmental policies and organizational programs. Their importance stems from the ways in which they influence people, and the response of the people to that influence. What is the image that people have of the government? Sometimes a good program is rejected not for its own sake but because of the people who are sponsoring it. Again, this interrelationship between public services and the people must be understood.

Finally, let me emphasize the role of the family as a system. The family has the power to make decisions, socializes, motivates and has motives, has certain kinds of interactions between

parents and children, and engages in other social relationships. There is often some degree of intergenerational conflict within the family. Thus, the family is a laboratory of reactions and change, and the response of the family to these changes must be understood.

In short, I have suggested six directions for future work. They are:

1. The study of modernization as macro- and microprocesses through time and not simply as the modernization of individuals or communities.
2. The study of social stratification as a multidimensional reality, and not simply as a sample general category.
3. The study of social mobility as both an independent and a dependent variable in relation to nutrition and mental development.
4. The analysis of the interaction of individuals in groups as intervening variables.
5. The study of social change and of the problems of societies in critical situations.
6. The necessity of introducing the perspective of political operations and practical obstacles in the evaluation of nutrition and other public service programs.

SUMMARY OF RESULTING DISCUSSION

The ultimate outcome of the modernization process is unknown. Some of its technological consequences, such as pollution, may lead to the destruction of society as we know it. The development of computers may make the options clearer while providing the single rational alternative. This introduces a significant philosophical question concerning our destiny, and what the ultimate outcome of modernity will be.

Increasing bureaucratization, which accompanies modernization, may limit choices once a track has been entered, but may also provide a wider choice of options. There is a reduction in system privacy, with a good deal known about individuals within a given system. But, at the same time, there is greater individual privacy, since individuals operate in a variety of systems at a given time, and there is separation between these systems. While computers may suggest the available options and the most rational alternatives within a system, the possibility of making the non-rational choice still exists. Many young people today are information-seeking animals, investing in life styles which have anticipated payoff and behaving in innovative and creative ways by rejecting the rational option choice.

Options which appear to exist in theory may not exist in fact, because of the severe negative sanctions which are applied to those who choose an alternative. In the United States, this may have been the case concerning the decision about whether or not to marry. While the option of not marrying existed, negative sanctions were often used against those who chose not to marry. Conversely, there was social pressure toward choosing the option of marriage as opposed to remaining single. Thus, the evaluation of options and option choices among a population depends, to a greater or lesser degree, on their perception of available options. Options need to be perceived in order to exist. The delineation of options requires obtaining information from individuals concerning their perceptions of available options, and their reasons for the choices they make.

How does this relate to nutrition or to psychological development? The relationship is complex, and not totally clear. Both modernization and the use of options relate to the internal structure of families. This internal structure is relevant to the psychological development of the members, particularly the

younger members, of the family. In many developing countries, we cannot go into the field with a series of preconceived notions based on the findings of family events in more advanced countries. The preferred strategy is to go into the field with an open mind, study families as they are, and attempt to develop some empirical types that can be related to the other variables under study.

The notion that modernization is an ethnocentric concept has become ritualized in recent years almost to the point of being a cliché. It is true that some ethnocentrism is involved in every scholarly research enterprise. This is partly because we cannot discard our cultural baggage and it is, therefore, bound to influence our perceptions, research directions and decisions. But modernization does not necessarily imply a linear process, or the exportation of cultural artifacts. If modernization is defined in terms of increased options, does this mean that we always move toward increased options, or toward fewer options?

This, in turn, is related to whether or not change is evolutionary. In an isolated setting with little or no contact with other social systems, change in the system can only be evolutionary. All departures from this must be based on the notion that the diffusion of ideas leads to change. The emphasis here is on the *diffusion of ideas*, and not the diffusion of artifacts or particular products. Ideas are and can be culture free, while particular products are apt to be ethnocentric. Selling the idea of good nutrition is culture free, while selling hamburgers and Coca-Cola is ethnocentric.

Education contributes to modernization through its influence on the perception of the desirability of improved life chances. This may create frustration if the social structure does not provide options for the better educated individual. The frustration may lead to demands for significant changes in the social system in order to increase the options available.

Ricciuti and Pollitt demonstrated that malnourished children in Lima scored poorly on a series of cognitive tasks as compared to control children from the same environment. In this study, stature was used as the primary measure of nutritional status. But children who differ in stature usually differ on several other factors as well. Pollitt, in a follow-up study, visited the homes of the taller and shorter children. He found that mothers of the taller children were themselves taller, and had more formal education than mothers of the shorter children. The educational differences, though small, (two years versus none) may be significant both in themselves and as indications of other unmeasured differences. Clearly, in areas where families produce malnourished children there are also families which do not produce mal-

nourished children. We are searching for better ways than the rough indices we currently have to describe the differences between these families. Are there characteristics of these families which predict both nutrition and intellectual development?

Rigorous construction of an index of socioeconomic status which utilizes income, education, occupational level and place of residence will often serve to adequately differentiate between social strata. Because of status crystallization, the problem of status differentiation is less acute at the lowest and highest reaches of society. It is important to keep in mind that in the lowest strata there are restrictions in life chances, and these processes affect nutritional behavior.

Part of the analytical difficulty arises from the need for sensitivity to within strata differences. To some extent, this is because what appears to be a homogenous stratum actually contains important differentiations which are related to differences in life chances. At the same time, there is a need to be sensitive to differential measurement requirements. While income, education, occupational level and place of residence are often the most useful measures, there will be some situations, particularly in isolated villages, where other indicators of status are equally or more useful. These other measures assume greater importance when it is necessary to differentiate within a fairly restricted status range.

Social status differences are not the only important factors within families predicting nutrition or intellectual development. The family is also related to the complex of norms and values within society. These, however, represent a different level of analysis than social strata or life chance variables. Families also represent interactional systems, both internally and in respect to their contact with the world beyond the family. It is essential to know more about the nature of these interactions which may be viewed in terms of options and competence in dealing with bureaucracies. Useful schema must be developed in order to measure the effects of internal interactions of the family concerning nutrition and intellectual development.

V



Social Expectation and Function

Competence and options: A theoretical essay, implications
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COMPETENCE AND OPTIONS: A THEORETICAL ESSAY, IMPLICATIONS FOR NUTRITIONAL RESEARCH

by

Marvin B. Sussman*

In a provocative paper on biological, environmental, and cultural factors affecting learning, Birch (1968) questions why malnutrition is a curse for certain groups in societies with abundant and enriched food supplies. His answer: money and education. He cites studies (Mayer, 1965; Jeans, *et al*, 1952; Delgado, *et al*, 1961) which substantiate the position that poverty and low education are associated with deterioration of physical and social conditions. Under these conditions, inadequate nutrition increases the risk of biological insult to the central nervous system. Likely consequences of protein-calorie deprivation include failure in learning during critical periods of mental development, inadequate physical growth, high susceptibility to infection, and behavioral apathy with little response to stimulation.

Income and education are correlated with, or effect, social change, and form the core of theories of social mobility in transitional and complex societies. They are used as indicators of individual mobility through job change, and of the social status of an individual or his family. However, an increase in income and education does not automatically produce equal changes in behaviors. Supplemental foods, largely protein, have been provided malnourished groups. These programs can be viewed as sources of income and of educational inputs for their recipients. As Barnes has noted, these expensive and extensive programs of nutritional education have not been an unqualified success (1968). This is a dismal finding, in view of the increasing evidence that malnutrition may inhibit adequate mental development, and that severe protein-calorie deprivation in early childhood may produce irreversible psychological retardation (Latham, 1969).

Barnes suggests that the failure to demonstrate clear-cut

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and long-term benefits of protein-calorie supplements is rooted in basic sociological and psychological issues. These include: myths about and attitudes towards food; interpersonal relationships within family, kinship and other primary groups; conceptual and ideological views of the relationship of nutrition to good health and to effective functioning in the society; the existence in the society of elite castes and class groups who view such programs as threatening the stability of existing superordinate-subordinate power relationships, and who hence overtly or covertly work to reduce program effectiveness.

The behavioral issues affecting nutritional outcomes can be expanded into an elaborate typology. For individuals, organizations, and societies, the acceptance and wise use of intervention to improve nutrition depends on the availability of options and constraints on their use. Individual competence to perceive the immediate and long-range benefits of these interventions will also affect their success. Program outcome depends, as well, on the responsiveness and capabilities of individuals who must meet organizational demands, on their competence to use the resources offered by the functionaries of human service systems, and on their abilities to confront or accommodate to the behavioral demands of these functionaries.

Income and education are needed to "make it," nutritionally, and in other ways. The infrequent success of nutritional education programs intended to change eating patterns and thus health status, and the failure to institutionalize those successes that do occur, are related to competence, to the availability and use of options, and to the linkages of individuals and primary groups to the organizational systems of the society.

Basic Concepts

The concepts of competence and options are veterans in the social psychological vineyard. They are being re-examined in the Cross National Family Research Project. Some concepts are more useful than others in their explanatory power because they "fit" the problem. Competence and options relate to the linkages between the family and organizations of the society. The principal functions of the family in complex societies, and in those undergoing the demographic transition, are: to develop and enhance the competence of its members to handle and use non-family bureaucratic organizations; to obtain new options; and to socialize members of differential capabilities and aspirations in the use of available options. We know little of the mechanisms involved in the linkage between the family and organizational systems in complex and transitional societies, but it is a key issue. Com-

petence and options are concepts which can be operationalized for empirical work on this issue. They are derived from a broader theoretical perspective of the organization and functions of family systems.

Theoretical Underpinnings

Studies of transitional societies have led to the erroneous impression that the family is a singular structure which is highly dependent on, and adapts to, the normative requirements of the newly-formed economic and political systems. Until recently it was accepted as axiomatic that the nuclear family, of gainfully employed husband, homemaker spouse and offspring, with the conventional pattern of sex-based role differentiation was the dominant structural form. This small, relatively isolated, "detached from kin" unit was regarded as best adapted to meet the demands for labor in the modern industrial society.

Recently a range of family patterns has been found in contemporary society. Differences exist in the isolation of the nuclear family from its matrix of kin and other intimate social relationships (Litwak, 1960, 1960-60; Sussman, 1962, 1965; Young, 1957; Willmott, 1960; Firth, 1964; *et al*), and in its internal role structure (Bott, 1957; Rapoport and Rapoport, 1966, 1969, 1970; Blood and Wolfe, 1960). Moreover there are variant family forms and each structure—single-parent, dual-work, "modified extended," "remarried" or commune families—has different problems with which to cope and varied internal and external relationships (Sussman, *et al* 1971).

These studies postulate that the modernization process is reciprocal. Families are adapting to urban and industrial life while influencing the development, form, and activities of contemporary social systems. There are some common elements in the modernization process, including learning to organize activities according to linear time scales, and learning to deal with bureaucratic organizations. However, there is considerable variation in specific structural and interactional patterns. Families differ in their adaptation to the complexities of modern life, and in their efforts to mitigate the demands and to influence the behavior of outside organizations such as the school, welfare agency, or factory. We are now just beginning to obtain a theoretical perspective and a scant body of empirical data about the merits of different kinds of family arrangements—of their capacity to socialize children; to enhance and facilitate the competence of their members to cope with the demands of other organizations; and to provide satisfactions and a "mentally healthy" environment for their members.

Families in societies undergoing a demographic transition are faced with fundamental changes in role relationships and the allocation of tasks among family members. "Modernization" occurs in a variety of patterns: through migration from rural to urban areas, through the introduction of industry to rural areas, or through engagement in a social change process at work in the environment. Where the family may previously have functioned as a nearly total productive, agricultural unit, the impact of urban life patterns is likely to require workers to leave their families and take positions in other social systems with specialized demands. Adult members are likely to take jobs where they are required to perform according to standards set by others who are quite remote from them. Children attend schools, and participate in other primary groups and organizational systems which make claims for adaptation upon them, while teaching the skills requisite to life in a modern urban setting.

The demographic transition may also take place with the adult female taking employment. Whatever else may be involved in this, she supplements the income of the family. She may become the co-principal or only breadwinner in the family. In families, especially urban ones, where the marital partners collectively contribute to the exchequer, there is increasing pressure upon the male member for greater participation in the internal role system of the family. This includes the sharing of tasks and additional responsibilities for the socialization of children.

In rural settings, older children or kinfolk living in the same household often take care of younger siblings and provide much of the basic preschool socialization. This pattern, although increasingly acknowledged, has received little investigation. One investigator has questioned the veracity of the empirical underpinnings of the "unidirectionalists" for their stressing the parent (superordinate) → child (subordinate) socialization system (Cogswell; 1968, 1969), which has resulted in erroneous reporting of socialization influentials. Siblings or other relatives have been overlooked as socialization agents for both the pre- and school-age child. In urban settings, a variety of arrangements for "bringing up" children are to be found. They range from cooperative care among families to professional day care services. We know too little about how non-family members function as socializing agents, consultants, role models, and educators who develop the competence and increase the options available to their charges.

Whether or not the adult female works, the position of the adult male tends to change as the family changes from the traditional patriarchal form. Increased education for the female and her participation in activities outside of the home, as well as

emphasis on the norm of equality voiced in the culture, press toward a more egalitarian structure. In fact, a range of pluralistic patterns tends to emerge.

Fundamental Processes

The explanation of family adaptive and influencing capabilities has been abbreviated (Sussman, 1968). For families in transitional and modern societies three fundamental processes are at work. They are: the assumption of major extra-familial roles by family members; the involvement of other agencies in the process of socialization and social control of family members; and the reciprocal character of these processes. This suggests the need for families as small social systems to acquire competence in facilitation, enablement, and accommodation.

The complex urban or industrial environment requires external participation. The essence of the modern situation is the existence of alternative patterns for meeting the contingencies of life. The variety of jobs, schools, residences, and facilities available to family members in the urban setting is relatively greater than in the less urbanized areas, with the largest number being available to the higher social classes and elites. Choices are continually being made from among alternative possibilities. For the children, as they acquire additional skills through informal and formal training systems, the potential range of options is even greater. More behavioral alternatives in Linton's (1936) sense, or increased choices in a life sector (such as jobs in the work area) characterize modern societies. With increasing modernity the number of options in any given life sector increases for an ever increasing number of people.

To choose is inevitable, but to make wise and adaptive choices is another matter. In the usual course, it is likely that the "best" and most adaptive choices are made on the basis of the greatest awareness of both the range of options available, and the processes of following through in the management of choices. The success of any option sequence involves: an initially realistic appraisal of self-imposed, group and societal constraints on successful outcome; adopting appropriate strategies to counteract these constraints; and then performing competently in the relevant roles and social structures involved.

Concepts: Competence

The focus on linkages, processes of adaptation, and influence of families with bureaucratic organizations stems from the observation that modern urban life places a heavy demand on individuals for efficient performance in a network of interpersonal

relations. Ability to cope with the resources, limitations, and normative demands of emerging bureaucratic structures is required. Concomitantly, there is extreme pressure on the family and other primary groups to prepare their members for using generalized coping skills, and to develop and use informal socialization systems for competence.

Competence is the combination of skills, attitudes, and motivations which enable the individual to operate effectively within his environment. Clearly, competence is as much required to cope with traditional environments as modern ones. However, from the diversity of social and economic structures within folk societies there is a convergence toward a relatively universal form of the modern technical society complete with bureaucracies. As a result, the variety of competencies adapted to local cultures is being replaced by an urban competence whose components have transcultural relevance. It is this modern form of competence that we identify as emergent in the populations of developing nations (Foote and Cottrell, 1955; Hall, 1959; Inkeles, 1966; Smith, 1965).

"Competence involves effective role performance for self and for society." (Smith, 1968) Therefore, any adequate set of empirical measures of this concept must tap both a fundamental set of skills and cognitive orientations, and the attitudes underlying the motivation to develop and use these skills. Obviously we are describing competence on the individual level. Fundamentally, the competent individual is one who possesses the ability to acquire, assess, and use alternatives to reach a goal. He can "work" the system to his advantage; subject his actions to reality testing; is self-assured and confident of the future; and feels that his motivation is as much for the welfare of others as it is for himself (Gladwin, 1967; Inkeles, 1966). Operationalization of competence is accomplished in association with the variables of options and life sectors.

Inkeles approaches an analysis of the components of competence by raising this question. What do modern or modernizing societies demand of their members in order to fill important positions within the social structure? He suggests a detailed sense of time; a command of a highly symbolic language; comprehension of mathematical concepts; general information in order to cope with the external environment; and a cognitive style characterized by abstract analysis and relativity (Inkeles 1966). Another element considered important is sensitivity to the politics of interaction.

The ability to order one's life according to the clock is suggested as a simple and reliable indicator of a man's competence to handle the normative demands of a complex society. Wearing

a watch becomes a demonstrative act, symbolizing the value of time. Even if the individual does not know how to tell time, and watch-clock owning is a status symbol, it is, nevertheless, the beginning of a process of socialization into roles and identities associated with a highly differentiated society. Concern about time is one readily observable item of behavior standing for both a specific skill and a general attitude.

Within the home, the presence of a clock suggests a time orientation for the family. The extent of time consciousness within the family can be ascertained by a few questions concerning home activities which can be scheduled, such as meals and the time of rising and retiring. This line of inquiry might suggest a search for rigidity which is uncharacteristic of modernity. On the contrary, our theme is that options in various life sectors for increasing numbers of individuals are the major characteristic of a "modern" society. We also recognize that organizational systems require conformity to those norms which purport to integrate disparate activities and functions into a unified whole, and hence a product. Time is one such organizing mechanism. Its proper use is a beginning prerequisite for the use of options in a complex society.

There are several problems associated with time as a measure of competence. It is probably most effective in delineating individuals and groups on the polar extremes of a traditional-modernity scale, and less effective in tapping modernity for those in middle positions, such as members of transitional societies. Technological process imposes time commitments upon those it serves or subjects. "making it" in the technical bureaucratic society requires "living by time." Consequently, it is far more important to probe for the meaning and uses of time within any population than in simply establishing the availability of watches and clocks.

The command of language, and particularly a vocabulary of abstract words and concepts, is a second element of competence. A vocabulary in which words stand for objects and actions rather than for complex ideas limits the comprehension of the bases for any new set of tasks or relationships. Inkeles reports William Lawrence's findings that some Appalachian respondents were unable to comprehend the concept of antonyms, the "black/white" level of word opposites (Lawrence, 1965). Simple word tests can be devised to measure this conceptual level. Establishing the "vocabulary pool" of the whole family, and scores of individual family members, will allow for intergenerational comparisons of the degree and rate of modernization.

Use of mathematical symbolism is a third element of competence. Arithmetical problems requiring use of abstract reason-

ing and logic may be a satisfactory measure of this element, especially for the young. Probing for understanding of the workings of occupational and marketing systems, the relationships of price, earnings, value, credit and its costs, may be the most appropriate measure of mathematical sophistication.

The amount of general information known to an individual or shared within the family is a fourth component of competence. Such knowledge provides the bases for acquiring specific information in training and management of everyday living. Success in "making it" in the complex society requires understanding the formal and informal routes to bureaucratic organizations. This involves a knowledge of individual or group linkers most likely to assist or constrain in relationships with organizational systems.

Testing for the knowledge base of a population requires adapting questions to the local culture. Most cultures would involve knowledge of how to organize a meeting; where to go to get the "best deal" in a given situation; how to cope with injustices on the job; and how and where to complain about neighborhood problems. An interview protocol of culturally equivalent questions should also determine the individual's exposure to the mass media—radio, newspapers, television and motion pictures. This is a vital source of knowledge, in contrast to that received in group relationships.

Cognitive style is the way in which individuals combine concepts and relate events, and is considered a fifth dimension of competence. The familiar distinction between abstract and concrete modes of thinking is generally inferred from analysis of verbal communication. It appears to be a class phenomenon. The middle classes are more holistic, analytical, historical, and integrative in explanations. The lower classes are more concrete, time-specific, non-analytical, and non-integrative in descriptions (Schatzman and Strauss, 1955).

The most important cognitive elements of competence are the propensity to generalize or classify persons and actions, and the ability to organize events according to a pattern or framework extending beyond the immediate perceptions of the subject. Our hypothesis is that the individual's comprehension of networks of interaction relating groups and events, and his ability to apply general categories to specific cases, are the cognitive style most conducive for effective functioning in transitional and modern societies.

There are a number of formally administered tests for measuring a person's ability to generalize and order various items. We suggest a more informal, somewhat clinical, technique which is particularly fitted to a longitudinal study requiring repeated

interviews and observations, with many opportunities to evaluate the subjects' general modes of cognition. It is the systematic analysis of qualitative data, obtained by the interviewer, framed around hypothetical situations requiring a general knowledge of community and organizational structure.

A sixth element of competence is sensitivity to the politics of interaction. Sensitivity refers to a facility in learning the nature of a situation and determining the most expedient ways to operate within and around it. Is the proper stance to cajole, confront, rebel, accommodate or be ambivalent? Seeking and obtaining options is an interaction arena with status dimensions and power relationships. It requires a high order of perceptive and manipulative capabilities. "Working the system" for individual or group advantage without destroying the organization or co-workers and harmonizing self- and other-oriented interests is the most salient characteristic of a modern individual. Measures of sensitivity will be obtained by problematic tests simulating group interaction, by paper and pencil tests, or by introducing experimental group situations.

Life Sectors

In societies of high complexity, there is an enormous occupational and industrial growth, together with a diversity of services performed by bureaucratic organizations. There are parallel increases in the size and elaborateness of administrative mechanisms. Individuals in primary groups, such as the family, are thrust into a bewildering maze of relationships. Increasingly, modern man has so many options that it is appropriate, for heuristic purposes, to organize all of his possible activities into life sectors.

Life sector is an analytic concept for categorizing and describing phenomena within a circumscribed spatial and interactional arena (Sussman, 1969; 1971). Activity within a life sector can be studied as an observable unit with a beginning, duration, and end. Its use provides a means for studying competence, use of options and the modernization process, by grouping need-satisfying behavior with organizational systems. A theoretical approach to life sector orders behaviors in relation to work, religion, health, housing, leisure, education and welfare. Behaviors are organized and catalogued on the social organizational level. Bureaucratic organizations, which have been created to help man in getting a job, education, or emotional response, and which generally provide formal socialization, are examined.

Consequently we conceptualize work, governmental, health, leisure, residential and family life sectors. Within each of these

are numerous bureaucratic organizations with which the individual, or the group, has to deal. For example, in the economic life sector, organizational structures to produce goods and services have been created within the work system. Trades and professions have formed unions or associations with their own bureaucratic structures. An extensive marketing system has developed, with complicated merchandising techniques, in which all individuals and families participate in order to satisfy their basic needs. Each of these subsystems within a life sector can become a unit of analysis.

The advantage of using the life sector as an analytic concept became evident during efforts to define and measure modernity and rate of modernization. Determining the level of modernity of the society, of a family or individual is one objective of the Cross National Family Research Project (Scheuch and Sussman, 1970). A review of empirical investigations suggests that any index which lumps together functioning in different life sectors can be grossly misleading. As in all scales, there is a tendency to gloss over variations, which often tell us more about human behavior than do the means or modes. It is possible for an individual to be modern in one life sector and moderately modern or traditional in another. One example of such a society is Pakistan, where the rate of modernization is rapid. Women are entering the professions in increasing numbers. In such roles they are competitive, aggressive, intellectually curious, highly motivated, and desire to become outstanding in their fields. At the end of the workday, when they return to the family sector, they "shed" their modernity. They put on traditional attire, assume subordinate roles in relation to their husbands and members of the kinship group who, by tradition, are accorded both power and status.

As increasingly life sectors become more unified as interaction systems, they develop norms, values, means and organizational structures similar to those found in total social systems. While individuals are obligated to participate in a number of these life sectors, it is possible—and often necessary—to concentrate one's energies within one or two of these sectors and to limit participation in the rest. Man thus becomes a multi-varied traditional-modern actor. He can exhibit his modernity in one or more sectors and be comfortable with his tribal-traditional behavior in others.

By this process of segmentation man establishes his modern identity from those sectors in which he has made the greatest effort. In more traditional societies participation in all sectors is required because of the openness and interconnectedness of his activities. Privacy is limited and the individual, unlike his

modern counterpart, cannot afford to specialize without sustaining a loss in status, income, etc. In fact he has fewer options in selecting sector specialization or roles within each sector.

Options

Two complementary levels of analysis are useful in discussing options. The first is a general (societal) analysis of alternatives or possibilities in making a decision, pursuing a particular course of action, or selecting a relationship. The second (social psychological) is an analysis of acceptance of options as assumption of new roles. The essential question is, how many possibilities or alternatives are available to the individual in a given society? More specifically, with increasing modernity, do more options become available for an increasing number of individuals in the various life sectors of that society?

Potential options are made available by the societal structure. In order for them to have meaning for the individual he must be aware of their existence, be able to differentiate between theoretical and realistic possibilities, perceive them as available to him, and desirable or acceptable to his value system. He must also possess the requisite level of competence to accept the option directly, or to understand the path for its attainment. Option awareness and competency are, in turn, the result of the socialization process. Competence, then, is the integrative concept which links the individual's internalization of information and skills with the potential positions of the social structure. The criterion of the level of competency exhibited by an individual is the "fit" of the total content of the continuing socialization process with the requirements of the society for participation in its valued positions.

There are four principal factors which limit the range of total societal options to any given member of that society. One is the set of group and organizational norms which automatically exclude option awareness and usage by individuals who are not in-group members. Restriction ranges from keeping individuals oblivious of options, to the actual barring of the use of those known to the individual. Classic examples are the varieties of discrimination against racial groups, women, the disabled, the aged and the poor, in even the most "advanced" nations.

A second restraining factor is the individual's knowledge of existing options. Such knowledge is hindered, in part, by the very complexity which creates these possibilities. In each life sector, organizational systems with varied goals, means, values and constraints present a multitude of roles. No individual approaches total awareness of the available options for roles and

behaviors, or is cognizant of the variety of organizational systems which generate, nurture and express them.

A third constraint stems from the value system of the individual and his primary group. Within any life sector there are some known and available options which violate the values and self-concept of the potential acceptor. A relatively low-paying job may be accepted because the work is clean, while the option to limit the size of one's family may be rejected as incompatible with religious teachings and kinship norms. Major values such as the pursuit of education, social mobility, career choice and so forth will directly affect the components of competence. They will also be reflected in the measures of those components. A multitude of other values which are lower in the hierarchy and more limited in scope can directly or indirectly influence option choices. The final limiting factor is the individual's own capabilities to handle the task requirements (technical competence) of any given option, or to cope with the personal or organizational interaction (political competence) necessary to acquire his desired choice (Colson, 1967).

Taking on an option other than those which are temporary in their impact or consequence for the individual is basically the assumption of a role within a life sector. Career or educational options are examples of role commitments which carry with them certain rights and obligations as well as limitations and constraints on future options. For example, if one chooses a technical school, his future occupational options are constrained. He is socialized into a particular set of skills and body of knowledge. He is committed to a limited number of technical jobs. Societal expectations are that he will become a technician and not a lawyer. In effect, the choice of a particular option within a major life sector moves the individual into a path which includes access to certain additional options and barriers to others.

The limitations and extensions which any given option may have for a particular individual are not necessarily confined to the life sector in which the option is presented. Options in major life sectors carry ramifications which pervade other life sectors. These ramifications may be of a purely structural nature; an employee must relocate in order to accept a desired job. Less obviously, the socialization (knowledge, skills, professional attitudes, etc.) learned as a result of one option selection may have consequences for the choice and attainment of options in other life sectors. Experience in "working the system" in applying for public housing may be indirectly relevant to obtaining maximum benefits from the community medical clinic.

Some options are particularly significant in the life history of most individuals. The option to marry or remain single, the ex-

tent and content of education and job choice, are such examples. Currently we are examining the non-monetary factors which affect job change (Sussman and Cogswell, 1971). Our results suggest that the prospect of moving to a distant location, taking on a new social status associated with the job, altering relations with family and kin, changing friendships and leisure activities creates what Robert Rapoport has termed an "option glut." The individual is confronted with new sets of options in each life sector and a reordering of priorities must occur. The potential of the new options as exciting experiences, and their competition with old choices, enter into the decision to move. Evaluation of alternatives which involves gains and losses playing one option against another enters into the decision. In sum, the choice of a particular job option carries with it an altered set of options in the other life sectors. Each of these potential options in turn carries a potential set of limitations and extensions among other sets of options, *ad infinitum*.

Motivation

Motivation is an important variable which often interacts with competence. It is a willingness to assess the range of newly available options and to reorient one's goals in relation to new opportunities. Confidence that one has some control over the events which shape life is assumed to predispose the individual to feelings of self-respect and hope for his own and his family's future. It is further assumed that these orientations lead to a flexibility which is essential for optimizing the potential avenues for mobility in a rapidly changing society. Motivation is viewed as an intervening variable between competence and option use. It is possible to possess all six elements of competence, and yet lack the necessary motivation to accept these options. It is equally possible to be motivated toward an option without having the necessary technical and social skills to meet its requirements.

The specific nature of motivation may vary according to one's stage in the life cycle. Since competency is derived from both formal and informal socialization, there is a need for sufficient incentive to persevere through the minimum stages of formal education. In childhood much of this motivation will come from other family members and primary and reference group associates, rather than from the recipient of the socialization. Once the early period of socialization has been concluded a subset of the total array of societal options becomes available to the individual. The size of this subset, and the cost of various option paths within it, will depend upon the degree of acquired competency the individual demonstrates. At this point motivation again enters the pic-

ture. Overcoming perceived or real obstacles to the acceptance of the potentially available options may require high levels of motivation. The importance of motivations being generated by significant others and socialization agents at this stage is obvious. These obstacles may be due to proscriptive norms (i.e., taboo occupations for women) or to requirements of learning additional skills.

There is a special type of motivation in which the option or goal is desired, but an understanding of the cultural or technical means is either lacking or rejected. Such motivation, sometimes backed by a show of power or by appeal to social sympathy, is often perceived as an irrational or irresponsible demand by the more sophisticated members of the society. In rapidly developing societies leaders may be motivated toward goals for which they cannot demonstrate the requisite competency.

Colson (1961) describes the Tonga of Zambia, who insisted that all Europeans, regardless of their qualifications or experience, be replaced by Africans at all levels of government administration. There were far too few Africans who possessed the level of competency for these positions, yet this was not considered relevant to the issue. Total independence was symbolized by having African officials. Similarly, in Thailand, teaching in the universities must be in Thai, although the curricula are, in the main, Western in theory and practice, and the texts and reference books are in English.

Social workers from the University of Puerto Rico (Sussman, 1969) have described a case that parallels the Tonga example on the technical level. La Barriada Morales, a slum area within the city of Caguas, until very recently had no telephones. When social workers began a community organization program, one of the first things the residents requested was the immediate installation of a telephone or, preferably, a regular telephone exchange. There was little if any comprehension of the technical requirements or costs of the installation of such a system.

The examples cited concern groups rather than individuals. Strong motivation accompanying inadequate levels of competency may be a special case among emergent nationally and politically conscious groups. Some migrant groups fall into this category. It is usually a temporary condition which diminishes with increased formal and informal socialization. When the trait is found at the level of individual aspirations, the explanation may lie in a strong identification with a politically active group. The relation of motivation to competence, on both the individual and group levels, needs empirical clarification.

Competence Revisited: Political and Technical

We have, thus far, been considering a generalized definition of competence as it determines the readiness of the individual or the family group to adapt to the overall demands of a modern, urban, industrial environment. For instance, the shift from the land to production and service jobs requires a change in concepts of time from one of seasons and daylight (traditional) to one of minutes, hours, and work weeks (linear). The ability to comprehend the instructions for carrying out even simple tasks demands an expanded vocabulary and, in many cases, a level of abstraction beyond that required in subsistence agriculture.

Elizabeth Colson (1961) distinguishes technical and political competence in her study of social change among the Tonga during the period in which the government was transferred from Colonial to local control. Technical competence is defined as the manipulation of materials and processes. Political competence is the ability to manipulate persons and events, and to work the system to one's advantage through knowledge of the channels of access and the use of influence.

This differentiation is similar to Parsons' definitions of task versus social interactional roles. It is useful here, providing an additional dimension through which we can distinguish the elements of competence. Colson's manipulative definition of political competence may tend to exclude more covert behaviors which actually indicate a high level of competency. For example, accommodating behavior in a situation in which one's sensitivities say "cool it" may be more indicative of competence than are aggressive attempts to control the situation or to force a counter-action. We feel that distinguishing this sensitivity aspect makes the dimension of political competency more inclusive. It now involves knowledgeable accommodation as well as overt manipulation, and can more conclusively tap competence behavior in situations where there are very few opportunities for manipulation. Consequently, we are dividing the second component of Colson's dichotomy, political competency, into two parts: political activist (overt manipulation) and political strategist (covert manipulation or purposeful accommodation).

Integrated Theoretical Perspective

Operationalization of the concept of competence has been undertaken within a theoretical framework involving option, life sector and socialization. The increasing division of labor and the array of services which result from an expanding urban-industrial base, multiplies the number of available positions in different life sectors. The positions and opportunities a modernizing

society makes available to its members become viable options for a given individual only when that individual demonstrates the requisite competence to recognize and pursue them. The degree of competence exhibited by any individual or by a closely interacting primary group, such as the family, is an outcome of the totality of formal and informal socializing experiences to which he (or it) has been exposed. Life sectors and options are structural elements on which the rational goals of socialization are established and against which the actual results are tested.

Life sectors such as work, religion and government have existed in some form since the days of primordial man. In complex societies, with their heightened differentiation, occupational specialization and training, and increasing separation of the home and work place, there has been a perceptible increase in the elaboration and distinction of the life sectors available to man and the number of roles he can opt for within each. He may be a searcher for and exerciser of options, or a passive receiver of them. Besides personal inclinations, the individual's option stature is influenced by his position in the social structure, which imposes constraints upon option experience in the major life sectors. Consequently, the ways in which the individual functions in option selection and usage in one life sector influences his option behavior in another. We view the network of options selected by an individual within each of the life sectors over time as constituting his "path history." (Hanson and Simmons, 1968)

Privacy has been mentioned as a phenomenon associated with increasing modernity. The increase in options creates a decreased system of privacy through social cataloging and registration of important life events. However, there is also increased individual privacy in social interaction within different life sectors. Social cataloging and the building of individual records tend to follow life sector lines. For example, the individual's record of educational achievements follows him throughout his life cycle, and evaluations are made in terms of the specialized norms of the educational sector. Performance in one life sector may or may not influence his roles and behaviors in other life sectors.

In complex societies, there is an increasing tendency to judge a man's life sector parts, and not the whole man. It is quite common for the manager of a factory to state, "I know that his home life is terrible and he is a lousy husband and beats his wife quite frequently, but as long as he's doing a good job for us that doesn't really matter," or for a client to say, "I know that he is a philanthropist but he is a damn good architect." Perceptual segmentation supports judgment of competence within a life sector. Current attacks upon invasions of privacy by governments and private sector organizations add support to segmentation of judgment. Ex-

posure of information gatherers and codifiers will reduce the potential carry-over of "incriminating evidence" from one life sector to another.

Even with social cataloging by bureaucratic organizations the individual with a poor record can minimize the potentially negative sanctions through manipulation. He can opt for major activity in a single life sector where he is highly successful, has a clean record, and has established his major identity. The bad husband, but excellent worker, is one such example. A physician who is a successful practitioner and who develops an international reputation because of his work with open-heart surgery may have a bad record as a marital partner, be a supporter of anti-establishment causes, a poor loser in friendly competitions, have a less-than-outstanding record as a scholar and teacher, and be a terror to work with. Yet, if he develops an identity and sources of power as a consequence of his success, all the prescribed records and potentially negative sanctions will have little or no effect upon him.

Increased individual privacy is a concomitant of increasing complexity. Nuclearization of family structure is increasingly the pattern of today's society. Even with the higher incidence of variant family structures, such as single-parent, dual-work, modified extended, three-generation, and commune, the pattern remains neo-local residence, being physically apart from other units. Separate dwelling units permit the division of space into still smaller components. The living quarters, once characterized by a sense of openness and communal rooms, now are "cubbyholed." This results in increased individual privacy. Even where an extended or stem family persists and family units reside in small households, such as apartments or few bedroom homes, there is an increase in the individual's interactional privacy. Familial obligations are more precisely set and are met within the framework of linear rather than natural time. The consequence is an increase in the social privacy of the individual family member.

Together with these changes in family structure, household living, and increased availability of options, there is a parallel proliferation of age, sex, and reference groups and an increasing dominance of their norms. The individual can come and go with less need to inform, obtain permission or seek approval from parents and kin members. Increased differentiation, complexity and life sector expansion create the ideology and ethos, as well as the demand, for increased private behavior. The individual who creates a major identity by successful participation in one life sector may be able to keep his performance record in other life sectors from public view.

In societies of increasing complexity not only do the number

of options in each life sector increase, but an increasing number of individuals achieve the opportunity to enter the option sequence within these sectors. The base for option availability reaches down into the masses. The need for expansion of options for the populace is usually expressed in the rhetoric of the ideology. The more obvious empirical reality is that complex societies cannot maintain their economic, social, and political systems unless there is an increase in the diverse avenues for obtaining and pursuing an option sequence.

An overall increase in individual self-expression and option choice parallels this development of expanding options and their availability. Societal norms which encourage this self-expression develop, as does an ideology of extensive freedom in option usage within a given life sector. Our position that with societal complexity the individual is autonomous and unconstrained, must be qualified. For any society, family, or individual, the life cycle stage, time in history, and stratification system qualify option availability in any life sector.

Major life sectors include education, welfare, leisure, work, housing and family. Each can be divided into subsectors according to their function and organizational structure. Individuals cannot possibly be equally competent in all areas of functioning. We may obtain a measure of the overall competence of the individual. However, the competence levels for participation in the major life sectors can be hierarchically ordered for any given individual.

Our assumption is that with increasing modernity life sectors become more clearly delineated as total social systems. While individuals are obligated to participate in a number of these life sectors, it is possible to opt for more extensive participation in some than in others, or to opt out of a life sector. Examples include the individual who retires early and becomes a pursuer of leisure, or the person who "turns off" from work in order to be a peace volunteer. Modern man increasingly has the option of selecting a life sector in which to concentrate his participation. Furthermore, within each life sector increasing modernity leads to more alternatives for roles and career lines.

The separation of lifeways into sectors and the suggestion that an array of options can be found within each sector are operational procedures for looking at the development of competence. In all probability, marked separation of option availability and choice according to life sectors does not exist. Few individuals have the ability or the desire to segment their lives into sectors and roles. The choice that an individual makes in one major life sector undoubtedly will influence his selection of options and be-

havior in other life sectors. The individual may even develop a generalized option stance.

The family is central to the development of competence through its informal socialization system. The family provides the psychological and physical territory in which one can be emotional, express one's feelings, and give and receive affective response. Relationships based upon mutual trust and reciprocal expectations, relatively free of status position constraints and characterized by a high degree of intimate interaction, characteristic of a primary group, enable the family to serve as a safety-valve system. The family serves the bureaucratic organization in handling the consequences of frustration. While the family as a social system can create frustrated members, our concern is how it nurtures and succors its mentally ill, and how it can prepare its members for effectively handling frustration and defeat.

The objectives and needs of the family are related to internal and external requirements for its survival. Internal requirements of any primary group are similar to those of any social system. Among the many requirements are role assignment of its members and development of reciprocal role expectations, the performance of tasks, and the development of a system of norms. Important functions of the family include socialization into appropriate roles, socialization for competence in handling internal and external relationships, and creation of an identity and concept of self. The external requirements include socialization for competence in linking the family with outside interstitial groups and bureaucratic organizations. This socialization includes the development of the knowledge of options and the skill to manipulate these perceived alternatives, the use of confrontation and of influence to solve problems, and, under certain conditions, to accommodate to the power of bureaucratic organizations.

Questions of importance for the researcher are as follows. Do different types of family structures (defined in terms of both internal and external criteria) manifest different degrees of competence in gaining information on available options and communicating them within the family? How is competence in the search for options increased? What family processes facilitate or impede the development of such competence?

How do families resolve dilemmas that arise between requirements for competent functioning in the different spheres to which family members are linked? Do families persist with a certain level of unresolved dilemmas, and does this level vary with family structure? What are the effects of different family patterns of handling unresolved dilemmas on their members' competence in handling their individual challenges in the particular spheres to which they are linked?

Implications for Nutritional Research

The conceptual components of this paper can be used in nutritional research. It is possible to use one or more of these conceptual elements as independent variables. For example, competence may be used in a study of the relationships of levels of competence to nutritional status. In such a study competence may be operationalized in terms of knowledge of food options, ability to get nutrients, and how these may be related to general health status and nutritional status. In one sense this approach of using competence as an independent variable is a reversal of the basic objectives of most nutritional research and demonstration projects. Current nutritional-behavioral theories stress the synergistic effects of nutritional deficiency, lack of intellectual and social stimulation, and infectious disease upon normal functioning. The hypothesis is that, if one can increase protein intake along with stimulation and make some efforts to control infectious disease, the individual will approach normality in terms of height, weight, and social functioning.

Such a conceptual framework is salient in efforts to bring about changes in individual behavior and performance as well as changes in groups. However, if one wishes to effect societal-wide changes in nutritional status and level of functioning of a population, or if one is less ambitious and wishes to change these same conditions in a more narrowly defined region, or community, by essentially effecting a shift in policies and programs, then one can use competence as an overriding variable. The question then becomes—how can you improve the competence of large numbers of individuals in obtaining their share of nutritional resources available in a community or a society? Emphasis is placed on the study of ways in which the number of options for jobs and economic resources can be increased for greater numbers of people in a society. With such reallocation of resources nutritional levels will rise as part of the sequence of events and activities which lead to an overall improvement in the quality of life. Consequently using competence as an independent, rather than a dependent, variable in nutritional research may result in a variety of research-demonstration projects intended to quickly raise the nutritional level of the underclass and improve the physical and social life of disenfranchised populations. The substantive issue for the applied researcher is the development of competence in large numbers of people for the purpose of more effectively using existing economic resources.

Some students of nutrition have suggested that malnutrition is a complex system of interactions involving the nutritional status of individuals, food intake, physical health, psychological sta-

tus, patterns of internal family dynamics, social group interactions, and participation in organizations and institutions. The mix of all these factors is accepted, but how each is related to the others is not clearly understood. It is this lack of understanding of the importance of each input to the total system that has led to the acceptance of the notion of synergistic effects. The integration of these elements is similar to the domino theory regarding the relationships between nations. It is believed that if you can modify one component element of the system it has rippling effects upon all other elements.

The sociologist who is concerned with small groups can see an opportunity in focusing on the family in action research aimed at improving the nutritional level and the quality of social functioning. If one concentrates on the family as a unit to trigger change, then efforts are directed primarily to developing the family as a competent socialization system which will demand the means to increase nutritional status of its members. These means include quality food and the right to good health by delivery systems built around the needs of families. The family as an active social system could promote the psychological well-being of its members, support family members' aspirations, facilitate achievement and enhance motivation of family members with differential capabilities and ambitions, and provide anticipatory socialization for family members in their dealings with non-family groups and bureaucracies. Action research would concentrate on the appropriate strategies to introduce into different types of family systems in order to improve the family's capabilities of developing a high-level socialization system for its members.

Nutritional-behavioral studies to date have indicated an association of a large number of factors: malnutrition, disease, social isolation, lack of stimulation, low receptivity, poor motor responses, poor health, slow rate of intellectual development, poor performance in school, irritability, and the like. This conglomerate of negative factors surrounds the malnourished child. Nutritionists and behavioral scientists will generally agree that one of the basic needs is for the child to develop a wide range of competencies by school age. The constraints and obstacles to developing competency in all roles may be so overwhelming that a more important strategy, and one which should be tested, is to set a limited objective in the development of role competence. Efforts would be concentrated on developing role competence in one or two life sectors where the malnourished child has an edge. The conceptual notion of life sectors is useful here. If professionals, parents, and other socialization agents focus on raising the competence level in the family and the peer group, this may be suffi-

cient to "carry" the child in other life sectors, where he is less effective, without diminishing the new high concept of self.

Kallen has raised the question, "Are there some variables which increase or decrease intellectual or social performance only when the individual is malnourished?" This kind of question can be studied through the assessment of role performance in different life sectors. It would be interesting to see if, controlling for the level of malnourishment, role competence or intellectual functioning of the individual varies accordingly by life sector.

A number of behavioral scientists concerned with nutritional research have suggested that mobility is a concomitant of modernity. Social mobility involves increasing one's competence to utilize existing options and to create new ones. It is also suggested that with increased social mobility there will be a parallel reduction or elimination of malnutrition. It is further suggested that the main task is to improve the competence level of families if one is going to reduce malnutrition. There is a good deal of logic to this position on the relationship of social mobility with options and competence. This framework lends itself to action-research on the ways of bringing change in a community or a society. If one concentrates on developing the competencies of a relatively few but strategically selected families, one may have a catalyst for generating massive changes in the demand for nutritional and health services with concomitant effects upon existing delivery systems. For one thing, families will to a greater extent begin to participate in the decision-making process regarding those issues which effect their life styles and life chances. With improved abilities comes increased demand for participation and control over one's future. Before long the nutritional-behavioral expert will be functioning more as a consultant than a controller of the action. This development will pave the way for a collaborative relationship between nutritional advocates and their clients, based on reciprocity and exchange with increased acceptance of nutritional practice as a component of a quality life.

NOTE: In the preparation of this paper I have utilized some materials previously developed with Margaret Brooks. I am especially indebted to Robert Rapoport, Betty E. Cogswell and Erwin Scheuch for the benefits received as a consequence of the intellectual exchanges with them. They are part of a brilliant group of researchers connected with the Cross National Family Research Group, which has been supported in part by Contract (PH43-68-972) from the National Institute of Child Health and Human Development.

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MEASURING ROLE COMPETENCE

by

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While some laymen and all social scientists speak of role, many persons find they have the same problem St. Augustine faced when confronted with the concept of time: he knew what it was until asked to define it. Personally, I have found a statistical-probability approach to the concept of role helpful. I have also found that such an approach helps fix the concept for persons with non-social science backgrounds. One reasoning process by which a person can arrive at the concept of role is the following.

Human behavior is not random. That is to say that consistencies are to be found in human behavior. These consistencies may characterize the behavior of an individual over many of his life's activities as parent, marriage partner, or productive worker. When we are looking at the consistencies of a person's behavior we are considering a psychological variable and we are not concerned with the concept of role as such. For example, Johnny may be bright or dull, paranoid or not paranoid, have low self-esteem or not have low self-esteem across many or all of his different behaviors.

On the other hand, there are consistencies in human behavior which characterize groups of persons in a society, or a sub-unit of society, regardless of their personal characteristics. There are ways mothers, fathers, marriage partners or members of an ethnic group behave and which do not, *per se*, have anything to do with personal characteristics.

Therefore, if we are considering the consistencies of a person's behavior across many activities (that is to say, across many roles), we are dealing with a psychological variable. But if we are considering the consistencies of a type of behavior (e.g. mothering) across many persons, we are dealing with a sociological variable. It is to these *consistencies within a type of behavior across many persons* that sociologists give the name of role.

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Of course, in the real world, any given behavior is influenced by both personal and social factors, so that the distinction I have sketched is purely conceptual. No one approach succeeds in explaining all of the variance in any given type of behavior.

With these ideas as a background, we can move to a more common definition of role as one part of the reciprocal set of human relationships characterized by a reciprocal set of rights and duties, as in the "rules" defining the relationship between mother and child, teacher and student, employer and employee. These rules are in large measure defined before the child is born, before the student enters the classroom or the employee the factory.

Therefore, if we wish to locate roles in order to measure them, we must look to the expectations people have about human behavior. These expectations may exist at the level of belief regarding one's rights and duties in a human relationship (at one end of the continuum) or these expectations may exist at the level of patterned reflexes, as in the infant's interaction with his mother. The point is that roles lie suspended in the expectations or beliefs that people have about some given human interaction.

It is this fact that makes the concept of role so abstract and seemingly difficult to grasp. For while calories, vitamins, neurons and synapses are easily reified and even such psychological abstractions as personality, intelligence or need for achievement are often treated as if they had some sort of concrete, individual existence, it is impossible to think of role as a purely individual phenomenon.

From our definition of role as a set of human relationships characterized by reciprocal rights and duties to be found in the expectations that persons have about human interaction, it follows that roles are always learned. This takes us to the second point of our discussion. What do we mean by role competence?

The Conceptual Meaning of Role Competence

I will avoid the term role development in favor of the concept of role competence. The very phrase "role development" may contain a semantic trap. The term development conjures up notions of unfolding, of one stage following another as in organic models of biological growth or as in Piagetian models of the development of intelligence. In fact, there is not very much research evidence to support a developmental theory of role learning.

Writing on the interrelation between personality and social systems, Parsons (Parsons and Bales, 1955; Parsons, 1958) theorized that the general principles of object relations through iden-

tification, object cathexis and internalization must be extended to the whole psychoanalytic theory of personality. For him, the most important part of reality, even for the infant, is *social* reality and the process of identification and internalization are dependent on the style of the mother-child and the child-family interaction. In this view, there emerges a basic theory of role development—the age and sex linked identity of the child.

In Parsons' view, identification, object cathexis, and internalization each designate an aspect of the integration of the personality in a social system, an integration which is characterized by a particular process of *learning* in a particular context of object relations.

Piaget (1962) clearly sketches a developmental theory of role learning when he discusses the stages of moral judgment in children. Emmerich (1968) has suggested that a child's cognition of roles follows a sequential course, just as cognitive growth in dealing with the physical world has been found to follow a sequential course by Piaget and others.

However, it is still unknown whether children from different cultures or from different social classes pass through the same stages at slower rates, or through different stages, in the cognition of social roles. This is one reason why on-going nutrition and mental development studies should include cognitive measures of both the impersonal and interpersonal world, so that the differential as well as parallel trends between these two areas might be discerned.

But to return to my other point. We are on safer ground if we avoid the term role-development—which biases the discussion in one direction from the start—and simply talk about role learning or socialization. This avoids the notion that one must have learned one role before learning another or that there is any precise information about sequences in such a model.

What is certain is that role behavior is *learned* behavior. Because role behavior, like other behavior, is learned, the models for studying how children learn various roles must take into account various theories of learning. Within this context, Havighurst (1970) has pointed out that the reward-punishment concept has been developed rather differently by three groups of psychologists. Learning theorists have tended to use this concept to refer to something done to the learner. Social psychologists and personality theorists have included the subjective experience of the learner as a source of reward or punishment. It is within this social psychological context that I will develop my ideas on measuring role competence.

Measuring Role Competence in Different Societies

One common view posits a hedonistic model of human interaction. In such a model, persons in a social system, that is to say, in a role net, attempt to maximize rewards at minimal personal costs, while at the same time sustaining the human interaction, provided it remains rewarding. (Thibaut and Kelley, 1959; Homans, 1958, 1961; Heider, 1958; Blau, 1964) The broadest possible definition of both subjective and culturally defined rewards and costs must be used if the generalizations are to explain the diversity of phenomena known to exist in various cultures. It is only within these assumptions that various theories of social exchange make logical sense and are supported by empirical evidence. Because of the level of generalization at which this type of role theory is constructed, the notion of role competence easily betrays culture-bound judgments. We are concerned with competence for what and by whose standards?

Most investigators would exhibit a great deal of role incompetence if they had to live for a week in the poor *barrios* of Bogotá. They might find their beliefs as to who they are and how they should be treated contradicted. They might have a hard time knowing how to treat others. On the other hand, a young citizen of these *barrios* might have the same problems were he suddenly a student at Harvard University.

People are socialized into different roles to meet different needs of a given society. Some persons are taught to accept an inferior status and other people profit from their easy acceptance of this role. The goal of optimal human development is, and must remain, a myth unless human development is defined in other-worldly terms which have nothing to do with the on-going social system. Hence, when we speak of role competence, we are referring to competence relative to an on-going society, and not to some abstract, absolute behavior. Social competence refers to the ability of people to fulfill needed social roles at a given point in time. This definition does not necessarily require that role competence is rewarded or that people necessarily arrive at their "proper" level of functioning in society.

The contemporary concern with role competence is often with role incompetence within contemporary society. Now, under the impact of rapid population growth and an accelerating move to the cities, the poor and uneducated are becoming a socially recognized problem. Old roles and old role competencies are no longer functional. At the same time, these people have a rising level of expectations. They want a life-style similar to our own. It is within this context that social science resources have come to emphasize the problems of the poor and the term "social compe-

tence" is newly heard around the board tables of private foundations and advisory groups of the Federal Government.

These statements are meant to alert us to what we are about. The contemporary research establishment is generally concerned over a given level of social competence for a given group of people, judged by another group of people as incompetent for a given society, at a given period of its development. For this reason it is important to keep the following in mind:

1. Our concern, though couched in abstract terms, is generally with a specific type of social competence related to the needs of societies in which we have a vested interest.

2. The conscious production of social competence may produce latent, unintended, and perhaps harmful side-effects for the persons we are trying to render competent.

3. People enter various social systems with values and norms which, we must assume, have equal currency with those of the system they enter. Our concern with social competence should respect these values. People should not be manipulated in ways which cause them to lose control of their destiny.

4. At times, the values and norms which differ from those of the larger society can be used to help people function within that society. There is a danger of taking a culture-bound view as to the workings of social systems associated with democracies, cities, or factories. (Bellah, 1957; Abegglen, 1958.)

5. Studying social competence in primitive societies, or in societies different from those we are concerned with, may help us understand, at a conceptual level, what is involved in effective social functioning.

6. The study of social competence requires a holistic view of how a society functions. One must take into account the interrelatedness of the institutions within a society, and the structure and function of various roles within the institutions. Attempts to manipulate social competence without such an overview may be useless or harmful.

Conceptual Frameworks for Measuring Social Competence

It is not my purpose to delineate the various strands of theory that bear on the conceptualization of social competence which Smith (1968) has recently reviewed. I am, rather, choosing one way of looking at social competence appropriate to a cross-cultural perspective, parts of which could be operationalized within the framework of the longitudinal field studies of nutrition and mental development currently underway. In this conceptuali-

zation, socialization is viewed in interpersonal, rather than in social, structural terms. It is conceived as a process through which personality and selfhood emerge in the course of role-taking, rather than a process in which persons acquire beliefs, knowledge, skills and motives which prepare them to occupy a sequence of niches in the social structure. This structure may differ broadly between a poor neighborhood in Boston, an *aldea* in rural Guatemala, and a poor *barrio* in Bogota. The social processes across the three cultures may be comparable if the point of comparison is taken from within each society rather than from a presumed cultural "universal."

Weinstein (1968) defines interpersonal competence as the skill which enables one to get others to think, feel, or do what one wants them to do. This definition is not as Machiavellian as it sounds. Broad theories of interpersonal exchange are based on a premise of hedonistic behavior. They attempt, at the same time, to explain the behavior of the saint as well as the sinner.

This theory of interpersonal competence is built on the premise of interpersonal exchange. A postulate of this theory is that interpersonal exchange is based both on personal identity and situational identity. Personal identity is what one claims to be: a *campesino*, a university student, a medical doctor, or a member of a good family. Situational identity is what one claims to be within some given situation: a good boy, a diligent student, a cooperative worker or a submissive wife.

Besides the standard learning of language and role which is, no doubt, related to the development of intelligence, Weinstein lists several specific qualities which may contribute to social competence:

1. A person must be able to take the role of the other accurately.
2. A person must be able to employ a large and varied *repertoire* of lines of action.
3. A person must know how to employ proper tactics when appropriate.

Emmerich (1968) suggests that social role development involves several psychological functions which must be mobilized and combined to produce appropriate role behavior:

1. A person must develop an accurate understanding of these roles.
2. A person must have the opportunity to learn these roles.
3. The person must be motivated to adopt appropriate social roles.

Emmerich and Weinstein identify the elements of social competence in much the same way. Weinstein's three points are covered in Emmerich's first two, and all relate to the cognitive aspect

of role competence. Emmerich's third point introduces those psychological functions related to motivation.

In the schemas of both men, it is necessary to have the skills which establish identities for one's self and for others. Establishing identities for others is known as *altercasting*. Identities can be withheld from others all together, in which case the interpersonal exchange usually comes to an end, or they can be made contingent on the other person's accepting a certain set of rules.

Satisfactory human exchange requires two or more persons reaching agreement as to their identities. When one person lacks the necessary background, skills, or credentials for a given role this agreement cannot be reached. In cases where agreement is possible, it is still necessary that persons be skilled at presenting themselves to establish a given identity. Sociological work and the social novel provide eloquent examples of how dress, diction, vocabulary, family name, physiognomy, institutional affiliation and even office paraphernalia provide clues as to whom one is or claims to be.

Physical or social traits which are debilitating to the establishment of a given identity are called stigma. In Goffman's (1963) terms, stigma is "the situation of the individual who is disqualified from full social acceptance." Race, color, nationality or physiognomy are examples of traits which are not subject to change, but which may be stigmatized within a given society and thereby interfere with a person's ability to establish identity and hence his personal competence.

In such cases, the most obvious way to improve the social competence of large groups is to change the beliefs that society may have about certain traits. No degree of good nutrition or high cognitive development will significantly help such stigmatized persons if society continues to deny such persons certain identities or access to certain roles. This is an extremely important point which needs constant repetition. Investigators concerned with individual human behavior will not expect to solve major social problems simply by intervention in individual lives.

But on the individual level, how do persons learn to be socially competent? Following the lead of Weinstein and Emmerich, what distal or proximal factors are related to accurate role-taking, a repertoire of lines of action, a perception of the appropriateness of roles, and motivation to adopt appropriate social roles.

Without pretending to be complete, let me sketch the factors that come to mind as related to the above-mentioned components of social competence. At the same time I will parenthetically name the variable to be measured.

The best way to know how a person is thinking or feeling is

to have played the role oneself. Since this is impossible for all roles, the next best way is to have had the experience of taking the role of Other. For this reason, the exposure of a child to a wide variety of types of role relationships should contribute to this empathic ability and to his interpersonal competence. A child who has interacted only with his parents, a teacher, and a narrow group of peers in a restricted social environment will have had less experience in role learning than a child exposed to nursery school, his father's professional colleagues and their sons, and middle class friends. (VARIABLES: breadth of experience; appropriate role models.)

The opportunity to take or see taken a variety of roles that facilitate life in modern, urban society is greatly affected by a more distal variable measured as social class background. Whether one is talking about social class in structural terms (e.g. the income and occupation of the parents) or in cultural terms (the parents' ideas about child-rearing), social class greatly affects role options. (VARIABLE: social class.)

Even children raised in cosmopolitan homes may be exposed to a limited number of roles. Imaginative play can broaden one's acquaintance with other roles provided that an older child or an adult provides the appropriate feedback. Play at being mother, father, doctor, nurse or teacher will be most constructive if there is an interested and imaginative older person willing to take the role of Other accurately. (VARIABLE: presence of a parent, teacher, or an older peer or sibling who plays with the child.)

Role accuracy may also be improved if the child's imagination is stimulated by role models appropriate to his society. For this reason, it is important that mass media do not present minority groups in stigmatized roles. (VARIABLE: exposure to appropriate presentation of roles in movies or television.)

While the child is learning a variety of roles, parents should make their affective responses clear to the child so that he receives an accurate picture of the impact of his acts. (VARIABLES: parental attention to the child's behavior; consistency-reaction to the child's behavior.)

On the other hand, some socialization practices may be malfunctional for a child such as when he learns role responses which are appropriate to a certain culture or social class and then is placed in a school or work environment where his standards are frequently invalidated. This is often the case with the child from a lower class home who is placed in a middle class school. (VARIABLE: interaction between home standards and institutional ones.)

Besides being able to take the role of the other accurately, it is necessary that the child be able to control the responses of oth-

ers, that is, have a repertoire of interpersonal tactics. The first interpersonal tactic that the infant uses is crying. It is here that interpersonal behavior in an exchange model may be profoundly influenced by personality factors. Children raised by very authoritarian parents, in a society which does not allow for any expression of hostility to parents, may be socialized to conformity and lack flexibility in role behavior. (VARIABLE: authoritarian child rearing practices.)

If a child's past efforts have not been rewarded, such a situation may lead to expectations of failure on the part of the child and low expectations of social competence. (VARIABLE: parental attention and reward system.)

A child may be socialized to think of himself in such a way that flexible role behavior becomes difficult. For example, some persons may think of themselves as above commercial activity or as too independent to engage in cooperative activity. Such self-concepts may find their basis in, or be reinforced by, cultural factors. (VARIABLE: culturally defined self concepts.)

Past socialization may lead to a failure avoidance rather than to a success maximization orientation to the world. Probably involved here is parental rejection as it leads to low self-esteem. (VARIABLE: socialization practices leading to a failure-avoidance orientation.)

Often, in times of rapid social change, as in the United States, or with a changed environment, as in urban migration, a child must choose between mutually exclusive roles. Two issues are at point here. How clear and consistent are the social roles to be learned? And what is the nature of the reinforcement used by socializing agents to teach certain roles? In conjunction with this latter question, which socializing agents are more important for a child in a rapidly changing environment and why are they more important? (VARIABLES: the ideas that parents themselves have about what constitutes appropriate behavior for their children; the reinforcements that parents use to teach such behavior; the congruence between these ideas and reality-demands made on the child by his larger environment.)

Within an exchange model of behavior, personal identity is related to social competence. It follows then that the whole literature related to self-esteem is pertinent. People with low self-esteem tend to be socially withdrawn and apprehensive—inclined to reject their own perception and judgment and to accept those of other people. They also lack the ease and skill that make for friendship and social participation. They are likely to be preoccupied with their own deficiencies and overwhelmed with feelings of helplessness, cautious in their risk taking and quick to cease their efforts. (Coopersmith, 1967)

One theory identifies the following elements as necessary conditions for the development of self-esteem in children: acceptance of the children by parents who themselves have high self-esteem; clearly defined limits and values which parents present to children; latitudes of behavior for the children within defined limits.

This combination of love-acceptance combined with limits indicates that the world has structure and meaning and defined expectations which, when met, are rewarded so that a person can define himself as successful. (VARIABLES: the self-esteem of the parents themselves, their love-acceptance of the children, the norms and values which they present to children as desirable, and the latitude children are allowed within the defined limits.)

In summary then, a number of points emerge to form a partial theory of role development.

1. Roles are learned.
2. For appropriate role learning, non-deviant social role models must be present and the child must have sufficient personal resources and opportunity to learn appropriate roles.
3. The contingencies of role learning, like the contingencies of any learning, must occur at the proper stage of the child's development and they must be properly spaced and timed.
4. The child must be motivated to adopt certain roles in preference to other roles because the rewards for adopting socially acceptable roles are greater than the rewards for adopting non-acceptable ones.

The Relationship Between Role Competence and Nutritional Status

If one assumes a relationship between nutritional status and cognitive development, then, in the theory I have just sketched, good nutrition is a necessary but not sufficient condition for appropriate role learning. David J. Kallen has suggested some ways that nutritional status might be related to role functioning.

1. Decreased energy level may affect the general learning process (and therefore role learning as well).
2. Disease and death rates may effect the emotional ties between parents and children and, by implication, the learning contingencies associated with appropriate role learning.
3. Some malnutrition may simply make people dull and thereby disqualify them for certain roles in society.
4. Malnutrition may lead to decreased energy levels making

it difficult or impossible for children to do or pay attention to all the things necessary for appropriate role functioning.

These hypotheses are credible and interesting and deserve to be tested. But I would suggest, for heuristic purposes, that a randomly selected group of social psychologists would not list the above hypotheses as the major issues involved in the development of role competence.

It seems clear to me that very dull children will, throughout life, have a more limited range of role options than bright children. But the conceptual framework I have sketched clearly implies that there is far more implicated in social competence than either good nutrition or good intelligence.

The question arises concerning what to measure and when to measure in a longitudinal study. In reference to role learning, Havighurst's scheme may be as helpful as any in giving us some clues. Havighurst argues that there are age-linked differences in the nature of the reward-punishment, the giver of the reward and punishment, and the skills affected.

From birth to the age of four, the nature of the reward-punishment concerns the physical-physiological appetites (food, sex, pain, toys, etc.). The giver of the reward-punishment is primarily the parents, and the areas of development affected are basic motor skills and basic mental skills. Between the ages of five and ten, the reward-punishment is more likely to be praise or disapproval from non-parental sources (teachers, self, peers) and the areas of development affected are social skills and social personality, special motor skills as in games, and special school related mental skills. From the age of ten onwards, the ego becomes the control of reward and punishment. The wider community becomes more important as the giver of rewards, and the areas of development affected are excitement, danger, knowledge and sex. As one gets into the adult years—which differ by society—the wider community through approval-disapproval from the ego prepares one for work and family roles.

If the Havighurst schema is correct, then the years from birth to the age of four are ideal for studying cognitive development, as measured by basic motor and mental skills. The reward-punishment system one should study concerns the satisfaction of the physical-physiological appetites.

On the other hand, the years from five to ten would have a maximum payoff for studying social competence. The reward-punishment system one should emphasize is approval-disapproval from parents, teachers, peers, self, and the interaction of all these. Just how one would measure competence would depend on a functional analysis of what children of these ages are required

to do, or should be required to do, to meet their own needs and the needs of their social systems.

Since it is almost a postulate of social psychology, in contrast to the psychiatric emphasis on the early years, that behavioral changes can and do occur during the whole life cycle, then the study of social competence can and should continue through the life cycle. Studies of social competence between the years of ten to fifteen should emphasize both the ego and the wider community as the source of that reward.

In studies of nutrition and mental development in children under five, emphasis should be placed on the measurement of food as nutrition. Emphasis should also be placed on food and feeding as situations which satisfy the child's appetites for fondling and affective, physical, human contact. We will want to design items to measure how well a child's physical and affective needs are met as well as the stimulation the child receives in both verbal and non-verbal ways.

In longitudinal studies of nutrition and development, one would, following Havighurst's lead, begin to test children's perceptions of the interpersonal world at around age four-and-a-half. At this same time, we should find out which behaviors the parents deem appropriate, which behavior they reward and which behaviors they punish. We would also like to know which behaviors the children themselves esteem and why. If measures in these categories are included in nutrition and mental development studies, then it would be possible to look at the relationship not only between nutrition and mental development, but also at the relationship between a variety of social and social-interaction measures and social competence using both nutritional status and intelligence as controls. The results might indicate that the solution to incompetent social performance does not lie in better nutrition, or in better mental development, but in changing the patterns of socialization so that children come to adopt those behaviors which allow them to prosper in the societies in which they live.

In conclusion, I would like to mention a broader framework which, I think, has merit. In a yet unpublished paper, Howard Freeman has pointed out the importance of developing criteria variables which allow the outcomes of field experiments to be measured in terms of the competence of persons to negotiate their social environments. Freeman calls this property "social viability." Current field studies and large-scale intervention programs now generally employ ratings that are operationalized measures of either normative sociological phenomena or of individual psychological properties or some combination of both. But both sets of measures have defects in offering policy guidance.

As an alternative tactic, Freeman proposes that we develop

parallel culture-bound measures that provide rankings of individuals on social system processes that are common to groups, communities, or nations. In the case of the nutrition field studies, he is asking whether improved nutrition will really have an impact on a person's participation in the economic process, the political system, or on his use of human resource services. In sum, will better nutrition really improve a person's "social viability?" He argues that social viability is a consequence of a finite number of individual characteristics and that these individual properties are developed primarily through culturally equivalent modes that render them similar from society to society. These characteristics might include adequate nutrition, immunity to or non-exposure to certain diseases, as well as a variety of interpersonal and structural characteristics that affect individuals. From the point of view of study design, one would sample the universe of normative sociological measures and individual properties and then relate them to a sampling of the dimensions that make up "social viability."

Freeman's proposal really calls for a major innovation in the way that evaluative research is done. But the idea of social viability and how to measure it is what the topic of social competence is about. Within such a framework both nutritional status and interpersonal competence would be scores on an overall scale of "social viability." Such research would certainly have great potential payoff for constructive social policy.

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DISCUSSANT'S COMMENTS

by

Reginaldo Zaccara de Campos*

Both of these papers are valuable contributions to the study of social competence, the use of options and role development. Dr. Sussman and Dr. Dragastin have presented an inventory of variables which, I think, would permit the measurement of these factors. This conference is characterized by being broadly interdisciplinary, or, perhaps, broadly multidisciplinary. In this sense, I will make a short comment about the matters under discussion, in the most practical way.

It is clear to me that malnutrition, understood as "the physiological lack in which sufficient nutrients of the proper type are not ingested or utilized by the individual," is not social behavior, but the result of some kind of social behavior. It is clear, too, that malnutrition is associated with other problems including parasitism, infectious diseases, reduced adult physical size, intellectual impairment, and so on. What is not clear is the kind of relationship that exists between these problems.

In relation to social competence and nutrition, Dr. Kallen has stated, "the extent to which individuals or groups who are malnourished are less able to perform adequate roles in the society, is unknown and unstudied." On the other hand, as Dr. Dragastin indicates, "the current concern with role competence is often a concern about role incompetence below a certain cutting point," or, in other words, "we are generally concerned about a given group of persons judged by another group of persons as incompetent for a given society at a given period of its development."

I suspect that it is very difficult to measure the level of social competence of a given population, because the concept of competence, as it is presented by Dr. Sussman, involves evaluation. According to Dr. Sussman's concepts, "Competence is the combination of skills, attitudes and motivations which enable the individual to operate effectively within his environment." Or, "the competent individual is one who possesses the ability to acquire,

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assess, and use alternatives to a goal, can work the system to his advantage, subjects his actions to reality testing and is self-assured, confident of the future and feels that his motivation is as much for the welfare of others as it is for self."

Following this line of thought, I may assume that malnourished children are the result of a lack of social competence in their parents. Thus, the successful man will not produce this kind of problem. In conclusion, I don't see how using ideal definitions will help us build an interdisciplinary model for analysis of factors related to nutrition.

DISCUSSANT'S COMMENTS

Howard E. Freeman*

I have had a good deal of difficulty in understanding the diffuseness in the discussions that have occurred at this conference. I can suggest a number of alternative reasons for this. Each of us apparently is concerned with our own field, and continually asks, "what is there that I can do in this field that will have some kind of payoff for my discipline?" In doing this, we are ignoring the interface between the various disciplines. We are complicating the problem by trying to embrace all the social sciences, all of nutrition and all of physiology in trying to deal with the linkages between them.

There are two problems which would be useful to focus on. The first is descriptive—namely, we have a triangle, so to speak, between nutrition, mental development and the social environment. It is not necessary to describe the dimensions of these fully in order to understand the linkages between them. We must attempt to discover the important overlaps between these three domains. Otherwise, we can continue the diffuseness without moving toward a greater understanding of important relationships.

The second problem can be understood in the context of my discipline. When sociologists teach at an undergraduate level, the use of vague and general terms does not make much difference. We use rather gross concepts, because greater specificity is not important to the understanding which students will have of the field. Unfortunately, when the various disciplines are combined, they continue to use these abstractions, without ever getting down to the level of concrete operationalized measures. But, if we are going to be able to specify something about the linkages between the three areas, we will have to begin talking in operational terms.

I want to treat this problem specifically. There are two critical structures to be considered. One is a series of social structural variables which are *both* vertical and horizontal. When one thinks about the environment in structural terms, one is trying to locate an individual in a complex, multidimensional space. This is

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one of my objections to concentrating on the vertical structure, when the horizontal dimension may be of equal importance. For example, it may be more important to know whether someone is a policeman or a fireman, since each learns different kinds of deviant techniques which may help the nutrition of their family. This difference exists even though they may both be on the same horizontal level with respect to education or income.

My plea is that we focus on what is important in the problem area being considered. The only social structural variables we care about are those which have some explanatory power in terms of variance in the indicators of nutrition or mental development. We are not interested in describing the social structures of all societies. A similar point can be made about interpersonal or social psychological variables.

Why is appropriate variable identification such a problem? In my own field, I do not believe that there is adequate literature on this subject in conceptual or theoretical fields. This being so, there is little to guide us as to what is related to nutrition or mental development. All we can do is be theoretically eclectic, and do a good deal of empirical research.

The field needs the development of some basic measures. We need valid and reliable indicators of a wide variety of social factors before the interface of social, mental and nutritional factors can really be examined. I think that the same measurement development is needed in the other two fields. There also needs to be some balance between the development of this methodology, and the development of descriptive and experimental studies.

This is not a new problem. Each time an effort has been made to look at the interface between social factors and something in the environment, the same problem has arisen. We can learn from the results of studies on mental health or educational or health problems. Questions must be asked about the dimensions and the variables, in terms of specific measurements, which have proved useful in analogous studies.

Here I think the papers are alerting us to some important dimensions. We do have indications from other studies that some of the factors Dragastin discussed usually operate. There are some dimensions of a social and psychological nature which tend to play a role when one is concerned with behavioral conditions, whether they are mental development tests, school performance, or whatever. And, indeed, some of these have tests, or we have some indications from bad tests of how good ones can be developed.

Sussman's paper provides us with other leads because a unit, called the family, has some impact on a person's growth and development as well as on his nutritional status. I would like to

know how one measures options within the family, so that it can be developed into a scale. Then one can examine whether it explains any of the variance in either mental development or nutritional status.

My last point concerns an area that has been insufficiently discussed during this conference. The variables we are dealing with in the sociological domain have two functions. First, they are part of the triad of mental development, nutrition and social factors. At this descriptive level each is of equal status. At an experimental level, the social variables can be thought of as intervening between nutrition and mental development.

Second, they function at a political level. This is implicit in the work currently being conducted, even though mental development becomes the dependent variable. We are not really interested in people's various levels of intelligence, or in their cognitive functioning at six months of age. In reality, we are concerned with how people engage themselves when they are responsible community members in order to secure some reasonable quality of life. In looking at the variables in this triadic way, it is necessary to ask, "Am I going to know anything more about whether people really are different depending on this dynamic triad, in terms of the quality of life they can obtain for themselves?" To do this, we need to be concerned with more than just a series of social psychological events such as coping or autonomy—nor can we simply measure options.

What is needed is a concern with how well the person can do when he is sixteen, in terms of economic trade-offs, or how well can he do when he is sixty in terms of anticipating the resources he will need for the remainder of his life.

This is an area where it is incumbent on us to derive some measures of social importance. While they might have to be modified due to cultural differences, they would demonstrate the relevance of what we are doing. I would like to end by urging you to make an investment in this area. It will be exceedingly important.

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SUMMARY OF RESULTING DISCUSSION

The notion of competence was presented at a fairly general level without examining its relevance for nutritional studies. Clearly, it is a mistake to assume that if families achieve a high level of competence, malnutrition would automatically disappear. It does seem reasonable to assume that families who have greater competence are less likely to find themselves in situations where their children are malnourished. Competence becomes particularly important when it is desirable to increase it. If the competence of families can be improved so that they can protest, fight and organize, there may be a resulting change in the quality of health and of life. If the capabilities of individuals and families to organize among themselves can be developed, it may initiate a process of social change which will lead to better nutrition and other improvements in life chances.

The position one takes on this is not unrelated to the position one takes in regard to the nature and utility of theory. One can assume that in the relevant fields we have a series of partial conceptual frameworks and no one of these is any better or worse than any other. If one makes this assumption, the rational approach is to sample from a variety of these frameworks rather than relying exclusively on one. However, one can assume theory is, in fact, useful and there will be beneficial results from the development of a single conceptual framework in which a series of logically related assumptions are made explicit. Given present knowledge, the greatest progress may be made through the development of a series of partial frameworks.

The variables relevant to the development and testing of a framework for social competence differ from those relevant to the development of a theory of intelligence. The common linkage is that both may depend on the quality and quantity of stimulation. Competence may be relatively undefined for any given society because the specific requirements for competent behavior may shift from one society to another. Clearly, the behavioral demands for competent behavior are quite different in a New York City slum than a Guatemalan village. The development of intelligence is a less important issue when compared to the development of social competence. Intelligence may have the same relationship to social competence as does lack of organic brain damage. It is a neces-

sary but not sufficient condition. Social change, which will improve life chances and life conditions of a given group, may be more dependent on the development of social competence than on changes in levels of intellectual performance.

The factors involved in competence and modernization can be ranked in terms of their effect on nutrition. Some may be harmful, some neutral, and some beneficial. For example, the shift from prolonged breast feeding to bottle feeding in developing societies may be a sign of the adoption of modern practices but may be clearly harmful nutritionally. The same is true of the introduction of bottled, non-nutritional drinks. It is, of course, difficult to separate the factors which lead to modernization from the importation of artifacts which give the appearance of modernization without its substance. This failure to distinguish between appearance and substance may be one of the factors which leads some critics to view theories of modernization as ethnocentric.

A useful research focus would be on the ability of the individual and the family to handle and control their environment. As societies become increasingly complex, they develop bureaucratic organizations in a variety of fields which have impact on the life of the individual and the family. Abstractly, it is possible to measure the capacity or capability of individuals and families to achieve a quality of life through their success in relating to these bureaucratic organizations. This can be done in any country by taking into account the level of complexity of the social organizations of that society and the particular cultural factors which affect behavioral style. Thus, a rural Guatemalan villager would not be expected to deal with these bureaucratic organizations in precisely the same way as a resident of New York City. This approach also focuses more clearly on families and individuals, as compared with an attempt to label whole societies as modern or non-modern.

As we consider the relationship between nutrition and either intellectual or social competence, it is proper to inquire why we believe nutrition should affect either one. Aside from the hypothesis that malnutrition reduces energy and this reduction of energy then has consequences for development, not much information has been provided about the mechanisms through which malnutrition may have an affect on intellectual or social competence. In fact, one could take the position that as increasing social controls are applied to the data, the amount of variance accounted for by nutrition is continually reduced.

An acceptance of this point of view has at least two consequences. It becomes proper and useful to view nutrition as only a part and perhaps a minor part of a total health-care package in which disease, medical care, sanitation, and so on become equally

important components. Our focus might shift from a specific concern about intellectual or social development of individuals to a concern about the quality of life. This, in turn, leads to a focus on helping individuals and families to become competent enough to insure their ability to change society for the improvement of the quality of life. This moves us into the whole area of the instigation of appropriate social changes. This, in turn, will create its own strategies and problems.

It does seem likely that in all societies there are some people who operate competently and some people who do not. In Latin America, for example, children who are marasmic come from families that are incompetent at the simplest level in being able to care for their children. This suggests that we need to focus more on the family, both as a target for change and as the best mechanism for producing nutritional improvement in children. This may lead us away from a concern with massive social changes to the development of intervention programs which focus primarily on bringing about change within the family. This change would be directed toward increasing the competence of the members of the family and perhaps of the family as a total unit. If this strategy is to succeed, however, it will be necessary to be more specific about the areas in which one wishes to improve competency. These areas may shift from society to society or from family to family. Part of this specification may be a consequence of the need to operationalize some of the components which appear to enter into competence. In doing this, care must be taken to differentiate the cultural regularities in a concept, such as time, from the functional use which it has in the lives of the individuals.

Another approach to intervention programs to develop competencies in children is to give them experiences where they can succeed. Middle class and well-organized lower class homes can provide this important kind of feedback to the child, relating to his ability to manipulate or interact constructively with the environment. The homes, where malnourished children are most apt to be found, do not provide this feedback. The malnourished child shows a general lowering of response capacity and also poor health. Poor health means much time in bed and less ability to take advantage of whatever exists in the environment to stimulate or be of interest to him. When he looks at the road, he does not have the energy to quickly observe what is going on. If this lowered energy level persists for long periods, the child has only the ability to focus inward. He is not getting the experiences he needs to help him develop in the early years. At the same time, the parents do not have the knowledge or time to give the child the experiences or feedback he needs to develop competence and

capabilities. Intervention programs could concentrate on providing the child experiences in which he learns that he can accomplish something. In this process, he learns something that significant others in his environment define as important. While the family would be the ideal setting for this type of intervention, it is clear that many families are unable to provide it. Programs outside the family which provide the stimulation and positive reinforcement along with nutritional rehabilitation need to be developed and expanded.

At the same time, the possibility exists, however remotely, that many of the deficits shown by malnourished children are the consequence of neurological or enzymatic deficits which are too subtle for present methodologies to measure. This is a controversial and relatively unexplored area. On the one hand, animal studies suggest the possibility of these enzymatic and neurological defects being present as a consequence of malnutrition. On the other hand, they have not been demonstrated to exist among malnourished children. Much of the behavior and many of the deficits of the malnourished child can be attributed to the social and psychological causes and correlates associated with malnutrition. It is, of course, impossible to conduct relevant studies among humans. Hence, a fuller resolution of this question must await the development of new methodologies which can be ethically used with human populations.

VI



Summary and Implications

Behavioral and social aspects

A. Kimball Romney

Medical and environmental aspects

Joseph J. Vitale

Summary of resulting discussion

Concluding remarks

Joginder Chopra

BEHAVIORAL AND SOCIAL ASPECTS

by

A. Kimball Romney*

During this conference, we have been concerned with both theoretical and methodological problems, but from our different perspectives. The best way to express some of my concerns about the approaches we have taken may be through an analogy. If we view the world as if it were water, then we have all been trying to measure the hardness of this water. However, our measuring instruments are less accurate than desired. Anyone can tell whether the water is frozen or running; we feel that if we had better measuring instruments, we could determine whether the variables were in the liquid or frozen state, or some stage between. It seems that our measuring instruments cannot do much beyond distinguishing whether the water is in the liquid or the solid state.

Unfortunately, we have spent little time in actually assessing tests of behavior, although the conference title suggested this to be the main theme. We did discuss, at great length, the utility of theory and the utility of measuring very concrete kinds of things. Two positions were taken in the discussions. One position may be called "rank empiricism." It holds that a search for meaningful relationships starts from measurement of concrete variables, and from these variables and relationships it will be possible to increase our understanding of the field. The other position may be labeled "bearing testimony about the utility of theory." It holds that you start with the theory, and then develop the appropriate measurements. This difference does exist, and probably no one's opinion about the utility of either approach has been changed by the conference.

This led me to wonder what the world would be like if we actually listened to each other, and what effect listening to each other would have on the research we conducted. One of the things that would happen is that more than one investigator would use the same kinds of measures. There would then be a way of com-

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paring the results from one part of the world to another, and from one study to another.

The work would start to be cumulative. This has not happened here. It would be constructive if we could just sit down and work, so that those specific, operational variables we consider fruitful could be examined carefully, permitting them to be applied in different studies. This would help in achieving cumulative results.

We discussed the contributions which could be made by different fields. Each field has developed its own world view and its own blind spots. These blind spots are in the heart of the field; that is, they are developed around the one thing which the field ought to be able to see. In my own field of anthropology, we gather our data through interviewing. Our blind spot is never looking at the interview process itself, although there is very good literature on interviewing. I could point out some of the blind spots in other fields represented here, but there is no need to be that concrete. The blind spots develop because people take themselves and their field too seriously. This, too, makes it more difficult to acquire cumulative results from different studies.

Only once during the conference did the political implications of the study of nutrition and mental development specifically emerge. It is an important area which must be considered. It is my opinion that as far as social action is concerned, people are not going to listen to us as scientists any more than we listen to each other. By assuming that our research will have profound implications for social policy, we are apt to create a feedback that will damage our science. Those who set policy may consider the possibility that supporting the basic sciences may lead to a solution to some social problems no faster than attacking the problem directly through social policy decisions and programs.

It is clear that nutrition cannot be separated from the total medical care package, anymore than intellectual development can be separated from training and the social milieu in which the individual grows up. We have, on the one hand, been discussing the complexity of the interrelationships, and on the other hand, suggesting that we want to keep the variables simple. Returning to the water analogy, if it turns out that the variables are, in fact, in the frozen or liquid state and there is a state in which the water is completely transformed, through, for example, malnutrition, then it is a waste of time to try to get narrow variations within these states. We may be looking through a microscope, when a magnifying glass or even our naked eye would do.

There is another problem which we have not considered. Your data determine your outcome, particularly since none of us have excellent theories. We can argue for a long time about the-

ory, but we seldom argue about data. Unfortunately, many of our results may be artifactual. By this I mean that we are confused about how these results are determined. For example, we pick the range of variation we are interested in, and this may determine the kind of output we have. We focus on the disadvantaged group—with, for example, an income of five dollars-a-month. To get a matching group, we may have to choose a group with a monthly income of ten dollars. This is twice as great an income. The fallacy comes when we extrapolate from the range of variation at that level, to the difference between twenty and twenty-one thousand dollars-a-month in the middle classes. Obviously, we all recognize there is something wrong with this. But the point I am trying to make is that we pick the range of variation we are interested in, and this may determine the kinds of output we obtain.

If you push this argument to its ultimate extreme, it is obvious that if you do not feed a person, he will die. It is also obvious that if you put an infant into a room with no social stimulation, he will not learn to talk or develop in other ways. Somewhere, the amount of variance we have in these variables is interacting with the ways in which we pick out samples. And this, along with their interaction with other things, such as genetic endowment, makes me moderately pessimistic about the short-term prospects for obtaining honest answers to the main problems.

MEDICAL AND ENVIRONMENTAL ASPECTS

by

Joseph J. Vitale*

I think the art of nutrition assessment is better than has been implied. As for defining nutritional deficiency, I think the tools are adequate. Also, growth, or height, or weight and height, combined with some biochemical measures provide a fairly adequate measure of the nutritional status or health status of an individual. Nutritional status, of course, is a component of health or health status.

In terms of mental development or intellectual performance I am willing to accept the fact that some children do not do as well in certain tests as do other children. I am not sure what this indicates and I shall return to this point.

In terms of whether people will become malnourished, I think we have some ideas. If I were to go into a home in Brookline, which probably has one of the higher per capita incomes in the country, and I saw children of well-educated people, I would say their chances of becoming malnourished were slim. On the other hand, if I should go into a home in Heliconia in Colombia or into a rural village home in Guatemala, I would say there is a greater chance of these children becoming malnourished. Is there any question that optimal physical growth and physical performance are related to the socioeconomic and educational structure within the society?

What the individual presents, it seems to me, is a combination of his genetic makeup and his environment. Let me illustrate with an example that some of you may be aware of. In our State there is a law requiring all newborns to be tested for PKU. Hence, it can be diagnosed early. While we have not completely solved the problem of treating and managing PKU, much of the sequelae of PKU in our society might be mitigated. However, if a child in a Guatemalan village had a phenylketonuria gene, there is no chance of it being recognized. And even if it were recognized, there is little chance for therapeutic treatment.

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Clearly one's nutritional or health status is a function of a great many factors.

I believe one of the problems is in attempting to causally relate malnutrition *per se* to performance. To my knowledge, there is not a study, either in progress or contemplated, that could, would or should suggest that the mere provision of protein and nutrients will significantly affect the "poor performance" or mitigate so-called "mental retardation" in areas where malnutrition exists. Even if I am wrong, the results would have little, if any, effect on the public health problem as we now recognize it. On a world basis, I believe that malnutrition and infectious diseases (which act synergistically) account for more mortality and morbidity than any other known combination of health problems affecting mankind. Yet, we know more about how to treat these conditions than we know about any other disease.

A major problem then is not a lack of protein or essential nutrients. It is a problem of maldistribution tied to the political and economic structures and bureaucracy and other less important factors operating in our society. I do not think it would be difficult to prove to you that gastroenteritis left untreated, liver disease left untreated, infectious diseases left untreated, lack of proper immunization, and mild to moderate malnutrition in a hostile environment if left untreated, would lead to the same level of poor performance in well-nourished, but medically untreated children, living in the best parts of Brookline. Perhaps the best we can ever hope to show is that the child with malnutrition is less attentive than the well-nourished child and, therefore, does poorly in subsequent testing. But does it really make any difference whether the child is unattentive because of malnutrition or because of repeated infections or lack of health care? Even medical care might not be sufficient since it alone does not affect the basic causes. Programs designed to provide optimal health care, nutritional status, physical growth or intellectual performance, however we define these terms, must be associated with the whole political, social, cultural and educational structure of the community.

I feel that if we continue to support programs which address themselves simply to the question, "What is the effect of malnutrition on mental development?", we will continue to spend money inefficiently. I do not have to be convinced that protein, vitamins and minerals are good for brain growth. I am convinced. I am also convinced that in many areas health care and preventive measures, defined in the broadest sense, would automatically result in more food for the individual involved. They would not lose the food because of severe infections. They would not lose it because of constant diarrhea. And they would not lose it

for a number of other reasons. If certain nutritional requirements are not being met, then let us meet them. I would suggest that we concern ourselves more with the question of health delivery systems and with an ongoing assessment of the kind of delivery systems involved. Programs designed to provide health care, again defined in the broadest sense, are of first priority. It is absurd to think of nutritional care as being distinct from good health care. To me, nutrition is but one component of many affecting both physical growth and mental development.

Finally, let me make it clear that the health-care teams should include not only physicians, but all the disciplines represented here. The combined efforts of educators, social scientists, nutritionists and other health-related personnel working in or through a health-delivery system should do much to sort out the variables and their interactions on the processes of intellectual performance.

SUMMARY OF RESULTING DISCUSSION

Clearly, nutrition must be studied in terms of its place in the total health package as well as in the context of other dimensions of poverty. A good deal could be learned from studies of children who were not in poverty cultures but who were subject to malnutrition. These might be children who have various malabsorption syndromes or children caught in wars or other natural disasters such as those in Nigeria. If these children were found not to show the kind of intellectual deficits which characterize children in the poverty groups, then a good deal of new knowledge would be gained.

It would also be worthwhile for the agencies sponsoring the major research projects, to provide incremental funds permitting replication of crucial instrumentation across the various studies. This would provide a better opportunity to obtain cumulative knowledge from these studies.

It was originally hoped that this conference would concentrate more on methodology and on the sharing of data. Unfortunately at this point, much of the data are not available. However, the conference focused on important concepts which must be considered in the development and implementation of the studies. It is difficult to thoroughly examine empirical relationships among these concepts and have an opportunity to utilize them in their studies.

Future conferences would have great utility. One conference would permit a small group of investigators to examine in considerable depth the assumptions, concepts and methods either within or across particular areas. The other conference would concentrate on cross fertilization through having a group, not involved in the studies, examine in depth available data emerging from the studies from their own particular point of view. Thus, experts in family, modernization or social structure could utilize their knowledge, understanding, theory and interpretations to deepen and broaden the utility of data currently being collected.

CONCLUDING REMARKS

by

Joginder G. Chopra*

The Pan American Health Organization is interested in assisting member Governments in developing integrated health programs. Dr. Vitale has emphasized that nutrition cannot be separated from total health care. This is well recognized. All our efforts are directed toward integrated health care. Even if the patient is admitted to the hospital, there is a follow-through after he returns to the community. I agree that we cannot really isolate nutrition and try to say only nutrition is going to affect mental development. It is total health care.

I was most impressed by the multidisciplinary approach. The conference involved specialists from different areas, who came to discuss tests of behavior. However, my impression is that we should have more interchange of ideas between different disciplines to discuss this and other health related areas.

For instance, there was discussion of the expectation that when food aid is given, the community will use it. We who have worked in the field of nutrition find that the food is given to the animals instead of to the infants. I think this has been mainly the result of the medical people not appreciating the role of behavioral sciences in assisting the implementation of health programs.

Similarly, I think many of us who have tried to conduct nutrition education programs felt quite frustrated because we emphasize nutrition education, but the mothers are not motivated enough to accept it. From this conference, I have learned how the community has the options, but whether it will take the options and use them is very important. This has been happening in many health programs, including maternal and child health clinics. The service is free, but the community neither accepts it nor makes use of it.

This interchange between different disciplines is important, not only in discussing research projects, but in total overall health projects. I hope that in PAHO we can have these kinds

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of meetings when we discuss other subject areas in general health.

In PAHO we are interested in stimulating interchange of information between investigators working in the same area. This has been the first interchange in this specific subject area. We have pointers that will enable us to have additional data in the next meeting. This will enable us to move even further ahead.

Finally, I would like to mention that we have already received inquiries from other regions of the world about this meeting. They are looking forward to the report of this session because this is the first time that the international health agencies have been involved in looking at this from several points of view.

I would like to thank all the participants for coming here and contributing to this meeting.

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